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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Twenty-Fifth Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 7th, 1902.

The Twenty-fifth Annual Meeting of the Western Gas Association will be held May 21st, 22d and 23d, 1902, in the New St. Charles Hotel, New Orleans, La., and will be called to order, at 10 A.M., by the President, Mr. Thos. D. Miller, of Dallas, Tex.

The Executive Committee has arranged for the presentation of the following papers:

"Experiments on Bench Fuel;" by Mr. W. A. Baehr, Denver, Col.

"Gasholder Specifications;" by Mr. H. A. Carpenter, Allegheny, Pa.

"Electrolysis;" by Mr. Jno. M. Humiston, Chicago, Ills.

"Beaumont Oil for Gas Making;" by Mr. Jno. H. Fitzgerald, Houston, Tex.

"Some Experiences in New Orleans;" by Mr. Bankson Taylor, New Orleans, La.

"Gas Engines;" by Mr. C. H. Nutting, Chicopee, Mass.

"Distributing Gas at High Pressure;" by Mr. Geo. F. Goodnow, Waukegan, Ills.

"Current Purifier Practice, and a New Form of Construction;" by Mr. F. H. Shelton, Philadelphia, Pa.

"Wrinkle Department;" edited by Mr. W. E. Steinwedell, Belleville, Ills.

A paper by Mr. B. E. Chollar, St. Louis, Mo.

The New St. Charles will be the Association headquarters. Rates for those attending will be as follows:

American plan: Two in room, $2.50 per day, each person; $3 per day one in a room. Rooms with bath, $3.50 per day and up.

European plan: Two in a room, $1 per day, each person; $1.50 per day and up, one in a room. Room with bath, accommodating two persons, $4.

Also, rates may be obtained from the Hotel Grunewald, Cosmopolitan and Denechand, as follows:

Grunewald: Strictly European, in connection with which there are two restaurants—Single rooms, $1 per day for each person occupying same. Room with bath, $2.50 per day.

Cosmopolitan: European plan, $1.50 per day and up.

Denechand: American plan, $2 to $3 per day; European plan, from $1 to $1.50 per day.

More satisfactory arrangements can be obtained by securing quarters in advance of meeting.

The New St. Charles Hotel Manager announces that they will have ample accommodations, except possibly that single rooms may be limited; but their double rooms will be satisfactory, as they are large and well located.

Arrangements are being made with the various Passenger Associations' representatives to obtain reduced rates to New Orleans, which will include all the territory east of the Rocky Mountains.

Gas companies are solicited to send representatives to become members

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of the Association. The membership fee is $10, annual dues thereafter, $5. The Association publishes in bound volumes proceedings of its meetings. Copies when published are furnished free to members.

Queries for the Question Box, if mailed to the Secretary in advance of the meeting, will de assigned to members for answer.

Any information regarding the meeting will be gladly given by the undersigned.

JAMES W. DUNBAR,
Secretary.

[OFFICIAL NOTICE.]

Fourth Annual Meeting, Southwestern Gas, Electric and Street Railway Association.

SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION,
OFFICE OF THE SECRETARY,
WACO, TEX., Feb. 8th, 1902.

The Fourth Annual Meeting of the Southwestern Gas, Electric and Street Railway Association will be held in San Antonio, Tex., on the 18th to the 21st of April, 1902. As the membership is alive with interest, both on account of the place selected to meet and the good results to be obtained, a successful meeting is therefore assured. The headquarters and programme in detail will be announced later.

T. H. STUART,
Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF WRINKLE DEPARTMENT.
BELLEVILLE, ILLS., February 12th, 1902.

This department is now open and ready for contributions, which will be presented at the Twenty-fifth Annual Meeting to be held next May. The active co-operation of all members and friends is earnestly solicited. Please forward contributions to the Editor before April 15th.

W. E. STEINWEDELL, Editor.

BRIEFLY TOLD.

NOTES.—With much regret we chronicle the demise of Wm. McDonald, the youthful son of Mr. Donald McDonald, and grandson of Mr. William McDonald, of Albany, N. Y., who died at the home of his parents, Albany, the night of the 9th inst.——The annual meeting of the shareholders in the Spanish-American Light and Power Company, Consolidated, will be held in Havana, Cuba, at noon to-morrow. It is thought that the meeting will be a vigorous one.——At the annual meeting of the Flatbush (Brooklyn, N. Y.) Gas Company the following Directors were elected: Felix Campbell, E. R. Chapman, Edward Johnson, W. A. Stedman, A. F. Stanniford, S. W. Cushman and C. A. Bramley.——The gas and electric light plants of Selma, Ala., which have gone into the control of the National Gas and Construction Company, of Phila., Pa., are to be reconstructed. Important concessions in the selling rates have been made.——The Fond du Lac (Wis.) Street Railway and Light Company, by virtue of franchises recently granted it by the authorities of the adjoining districts of North Fond du Lac and Friendship, will extend its gas service to and through the places named.——The municipal gas plant at Westfield, Mass., is to be overhauled this season, provided the sensible demands of Supt. Pettibone are acted upon favorably by the "powers that are." It is quite certain that such consent and indorsement will be granted.——Supt. Knowles, of the Richmond (Va.) City Gas Works, has renewed his requisition detailing the necessity that exists for a storage holder in the western section of the city. If such a vessel is not constructed this season, the residents of the West End will have trouble with their gas supply next winter.——The Pittsfield (Mass.) Coal Gas Company will put down several miles of main pipe this season. The contract for furnishing 30,000 feet of 4, 6 and 8-inch pipe on such account has been awarded to the Utica (N. Y.) Pipe Foundry Company.——The negotiations for the necessary permission by the United States Legislature, to permit the consolidation of the Washington and Georgetown (D. C.) Gas Light Companies, have reached the point which seems to insure the success of the scheme.——The stockholders of the Columbus (O.) Gas Light and Heating Company will not receive notice of their allotment of the new stock which they may purchase at par until June 5th.

[CONTINUED FROM PAGE 494.]

PROCEEDINGS, EIGHTEENTH ANNUAL MEETING, OHIO GAS LIGHT ASSOCIATION.

HELD IN COLUMBUS, O., MARCH 19 AND 20, 1902.

FIRST DAY, MARCH 19, AFTERNOON SESSION.

The afternoon session was called to order pursuant to adjournment. The President stated that a contribution to the written discussion on the question

ARE LOOSE-LEAF LEDGERS DESIRABLE FOR GAS COMPANY RECORDS?

prepared by Mr. S. J. Glass, of Milwaukee, had been received too late for reading at the morning session, when the subject proper was before the Association. The Glass communication was as follows:

The question assigned me was, "Are Loose-Leaf Ledgers Desirable for Gas Company Records?" Assuming that the question was to apply to other records than simply ledgers, I will take up the card and loose-leaf ledger system generally.

The modern system of accounting in gas offices necessitates a great deal more detail than was necessary a few years since, when business was small, and one man could be depended upon to furnish all kinds of information from memory, and record books were of but little importance. Inability to take care of the extra detail, necessitated by the increase of business without adding heavily to the expense account, has probably deterred many from keeping the records which they should. From personal experience I know of nothing which has helped on these lines more than the card and loose-leaf systems.

For application blanks, meter records, stove records, street lamp, service and main data, indexes, etc., the card system is especially well adapted, in many cases one card doing away with use of two or more books. In addition to this saving the ease with which filing work can be done and reference be made effect a very material economy in time.

Where it is not considered advisable to use cards loose-leaf books can frequently be used to very great advantage. The greatest objection I have heard raised to the loose-leaf ledgers has been that the leaves may be lost or wilfully destroyed, thus doing away with the permanency of the record. The question as to whether the courts would consider records kept in this manner as being as reliable as those kept in the old-fashioned, bound book has also been brought up against this system. I feel that the employment of careful help will eliminate in great part any danger from the losing of leaves, and that the wilful destruction of the leaves could just as well apply to the bound books, but the ability to prove the accuracy of the records, if we were obliged to present them in court, is a very serious question—so serious that I should hesitate to recommend loose-leaf ledgers for our general books; but for petty ledgers I am much in favor of them. With them there is never the bugbear presented to the bookkeeper of transferring a great number of accounts from the old ledger to the new one, nor does he have a vast amount of dead material to look through when drawing off his balance. By easy reference he has a complete record of every account with which he has any dealings, and the ledgers practically index themselves.

For the consumers' ledgers, where practically all the accounts are opened and closed monthly, I have never been able to see any advantage in using the loose-leaf system. On the contrary, it has always appeared to me as if much more time were required in keeping the records on that kind of book than on the form which has been in general use by most gas companies for many years.

The President—If no discussion or comment is to be offered in addition to what has already been said on this topic, we will take up the next number, which is the matter of

COKE HANDLING.

The first communication on the topic, by Mr. K. M. Mitchell, which in the absence of the author was read by Mr. F. W. Stone, is as follows:

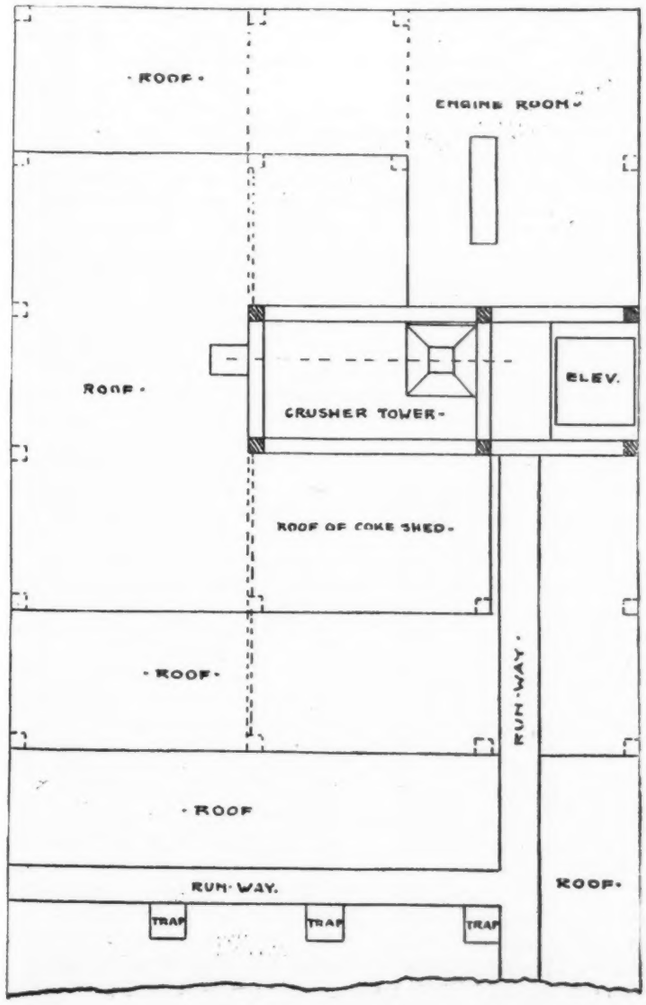
In our text books on gas manufacture much is said about the working up of the residuals, coal tar and ammoniacal liquor, but very little of the most valuable of them all; namely, coke. Each manager must decide for himself how he may best dispose of this product. Very little is done comparatively toward making a market for it in his own city. As a rule, he defers action until every available spot in the gas yard is covered with mountains of coke, then we find him shipping his product to some other market and at a cut price. The writer believes that every bushel of coke made in the gas retorts of a city gas works can be sold in the market of the city where it is produced.

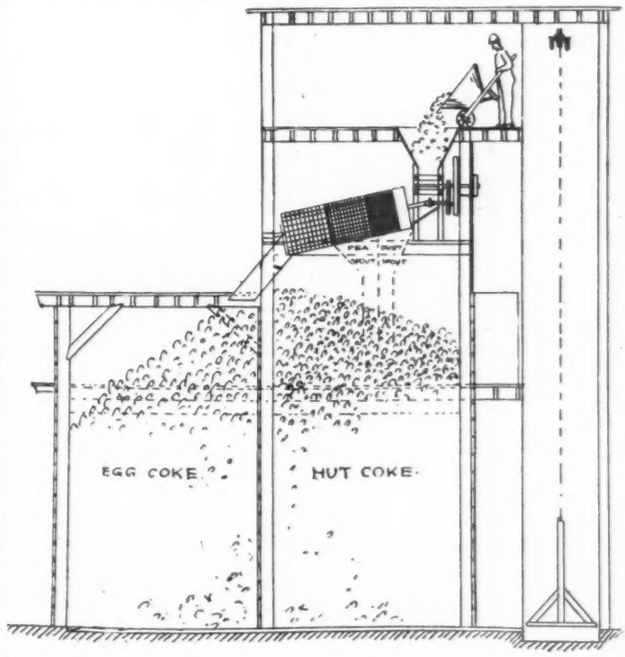
The question is asked, "What price shall we demand for our coke?" The reply would be; the situation governs the price. It depends upon the cost of other fuels. Lump coke should bring $1.50 per ton more than soft coal; egg and nut, a little less than anthracite.

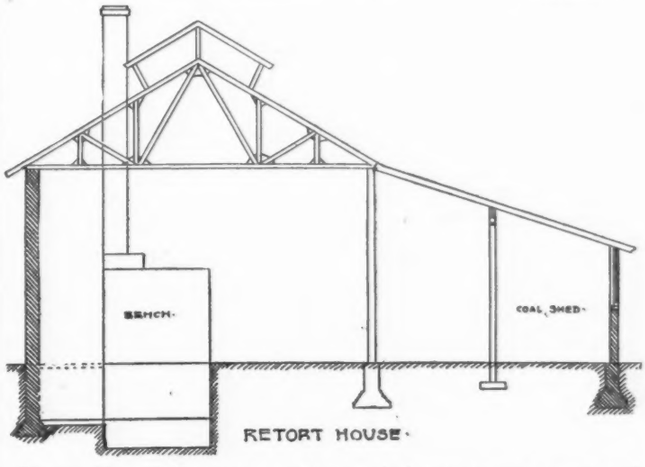
I cannot do better than give you a history of our experience in handling coke in St. Joseph, Mo., where for 17 years (except the past year) we have never carried over a ton of coke from one season to the other.

Years ago, when we were about to establish a system of regenerative furnaces, I was explaining to one of our Directors how we would make more gas per bench and save more coke. He thought the making of more gas all right, but suggested that we put in a furnace that would consume the coke, as we had such a supply on hand. My reply to this was that we would crush the coke and sell it in the local market, and that I felt confident we could work up a good trade—the company before us had consumed all the coke that was made, and the general public did not know what gas house coke meant. We purchased a crusher, put it on top of the coke shed, and elevated the coke into the hopper of the crusher, by means of iron buckets attached to belt elevator. The crushed coke, as it comes from the crusher, falls on stationary screens placed at the proper incline. We make what we call nut, egg and pea coke. We found elevating the coke by means of belt and buckets was unsatisfactory, on account of the wear and tear and occasional choking up of the hopper.

We then arranged the system we now have in use as shown in the sketch. The crusher is placed at a height of about 40 feet, and operated by a small steam engine, placed in the top of tower, connected by chain belting to crusher. As the coke is crushed it is directed into the end of a circular revolving screen; the screen is arranged for dust, pea and nut coke. The egg size passes out of the end of the screen, where it falls into bins prepared for it, and the other sizes of coke. We deposit the lump coke in the coke shed, wheeling it out on board runways until pile gets too high for convenient wheeling. We then use the elevator and raise coke to height of the roof, where various runways are prepared, leading to several openings in the roof, where the coke is dumped upon the pile built up from below. We try not to have the coke fall from a greater height than necessary, so as to guard against breaking it. When the coke is quenched as it comes from the retorts, we use as little water as possible, in order to avoid water soaking. As far as possible we keep our coke under sheds. Moisture deteriorates and slacks it. Dry coke is more salable.







Our experience is that coke must be crushed into two sizes, nut and egg. The nut is used in medium and small-sized base burning and cook stoves; the egg in large base-burning and soft coal stoves and grates. Lump coke is used in large soft coal stoves, house furnaces, bakeries, laundries, confectioneries, and upright steam boilers. Great quantities are used in the furnaces of brick kilns, for water smoking or drying the brick, the coke taking the place of wood.

Cost of Crushing and Elevating 1 Ton, or 50 Bushels, of Coke.

50 bushels of lump coke at 8 cents per bushel (40 pounds)		$4.00
Produced 22 bushels nut coke at 11 cents	$2.42	
" 22 bushels of egg coke at 9 cents	1.98	
" 2 bushels of pea coke at 8 cents	.16	
	$4.56	
Cost of elevating and crushing	.50	
	$4.06	$4.06
Gain		.06

The coke wheeler starts and stops the engine which operates the crusher.

We must depend principally upon the domestic use of coke for its disposal, and this branch of our business must be managed by every legi-

timate means. We have found judicious newspaper advertising advantageous, also sending out dodgers during the winter season. We pay special attention to coke orders, and give prompt and careful delivery. We have the reputation of having polite and obliging teamsters, and this we find helps largely in selling coke. If we have a customer who does not understand the use of coke we send our experienced man to start the fire. We are also asked to advise proper stoves in which to burn coke. We select a stove that will use egg coke. A good coke stove must be attractive in appearance, reasonably cheap, and must be air-tight at bottom, so as to hold fire.

The question is often asked, "Will coke keep fire over night?" The fire bowl must be large and deep enough to hold a scuttle of coke. A large door at side above the firebox must be provided, and a shaking grate and pokerhole on a level with top of grate (if coke contains clinkers). The firebox lining should be made in sections so as to be easily replaced. This stove takes the place of a base burning anthracite and soft coal stove. It has the qualities of a base burner, in that it holds fire a long time and is equally as clean. The advantages of coke over soft coal are so evident and so numerous, that it is not necessary to mention them.

We cannot be too emphatic in our praises of our product, for in it we have the most valuable domestic fuel on the market, and we should never be ashamed to speak of it as such.

Prepare your coke, advertise, solicit the business in the same manner that we see other merchants doing, and I know from personal experience that you will dispose of your product at good prices, and show a very handsome increase in your dividends at the end of the year.

The communication on this topic, by Mr. Irvin Butterworth, of Denver, Col., which was read by Mr. George Whysall, is as follows:

I can take issue with Mr. Mitchell on only one of his statements; namely, "That every bushel of coke made in gas retorts of a city gas works can be sold in the market of the city where it is produced." This is hardly true of those cities that are abundantly supplied with cheap natural gas.

Mr. Mitchell's opinions and experiences are extremely valuable, and his success in developing an excellent market for his coke in St. Joseph, Mo., should stimulate other companies to reach the goal of prices mentioned by him, namely; lump coke, $1.50 per ton more than soft coal, egg and nut a little less than anthracite. By carefully preparing our coke for sale in various assorted sizes, keeping it clean and dry, delivering promptly by courteous drivers showing the inexperienced how to use coke, in fact by looking closely after every detail entering into the cultivation of the business, it is absolutely astonishing what a large and profitable coke market can be developed in any city. Even those companies that are at present making the best records in this branch of our business could do still better if they should try harder.

Of course, in this, as in almost every other department of our business, local conditions must necessarily more or less govern our methods. For instance, in some cities and with some qualities of coke, a crusher might not be necessary to the realizing of the largest possible profit from the coke, and a screen may be advantageously used instead. In Denver, for instance, our coke is rather soft and easily broken, and thus far we have been able to supply the demand for nut sized coke by simply screening all our breeze by means of a shaking screen operated by an electric motor. As we build up a greater demand for nut coke, we can probably increase our supply of this size by also screening a portion of our coke just as it comes from the retorts. In Milwaukee and other cities, all the coke is screened, and no crusher, I believe, is used. I am inclined to think that this is a good plan, as a crusher always increases the production of dust and fine screenings, which means an additional loss. From our experience in Denver, I am also inclined to believe that a shaking screen is more economical and satisfactory than are revolving screens.

A concise and conservative rule might be something like this: Ascertain the probable proportions of the different sizes of coke demanded by, or susceptible of being most profitably marketed in your city, and use a screen for separating these various sizes. If screening all your coke should not produce a sufficient proportion of small sizes, then supplement the screen by crushing a portion of the coke to the sizes required.

An ideal coke plant, and probably the most profitable one, would be one in which the coke would be stored dry and clean, in carefully assorted sizes in overhead bins, from which it could be quickly loaded into delivery wagons by gravity. The delivery of water, ice, snow and dirt with coke, is, to say the least, a very unprofitable and short-sighted policy. I am of the opinion that in almost every instance we can obtain the maximum profits from our coke by retailing it ourselves rather than by selling our entire production to a contractor or dealer.

In Denver, in addition to the usual methods of soliciting and advertising, we have made arrangements by which the various branch offices of the American District Telegraph Company throughout the city, where our gas bills are payable under the plan now generally in vogue, are also allowed liberal commissions for taking coke orders, each office being equipped with a brilliantly painted box composed of compartments containing the various sizes of coke, each properly labeled.

The larger companies can well afford to delegate a suitable man who shall devote his entire time to the development and management of their coke business. This we are doing in Denver with the result that we are netting 75 cents per ton more for our coke now than we did a year ago. Our man makes it a point not to have a single dissatisfied coke customer on his books. Every complaint is adjusted to the entire satisfaction of the customer at whatever cost, in reason, to the Company.

Discussion.

Mr. Whysall—I agree heartily with Mr. Butterworth in his statement that it is necessary to adapt the different sizes to the particular uses for which they are intended. Coke of any size will burn in a stove if given a sufficient amount of draft, but the degree of success attending its use depends wholly upon its size. For instance, in a base-burning, hard coal stove, you can use pea coke and get good results, but coke of a larger size will give better results, while egg size coke, especially in a small stove, will give very poor results.

The President—Mr. Whysall, don't you think it is as important a feature in increasing our earnings to attend to the coke business as any other branch of the business?

Mr. Whysall—I think that is the weak point with a majority of the gas companies.

The Secretary—Does Mr. Whysall find a local market for the large output of coke at Hamilton?

Mr. Whysall—We have no difficulty whatever in disposing of our entire output, the bulk of which is sold for foundry purposes, however. The demand for domestic coke far exceeds the supply. In fact, we are unable to look at that business at all.

The President—What is your production of coke per day?

Mr. Whysall—About 200 tons.

The President—What is the population of Hamilton?

Mr. Whysall—26,000 inhabitants.

The President—That gives you a coke consumption of more than 15 pounds per inhabitant per day, so that no one of us need consider we have an over supply until we are selling more than 15 pounds per inhabitant per day.

Mr. Whysall—In that statement, Mr. President, I think you overlook the fact that a large percentage of this coke is sold for foundry purposes.

The President—There are industries in all towns.

Mr. Whysall—Yes, there are industries in all towns.

Mr. Perkins—I would like to ask Mr. Whysall if that coke is all sold in Hamilton, or whether some of it is sold in surrounding towns?

Mr. Whysall—Some of it is sold in the surrounding towns.

Mr. Perkins—Isn't the larger portion of it sold outside of the city of Hamilton?

Mr. Whysall—Yes; except our domestic coke. Most of our domestic coke is used in town.

The President—Mr. Miller, do you sell all of your coke locally in Cincinnati?

Mr. Miller—We sell it all locally; but the contractor does not.

The President—What percentage is sold right in the city of Cincinnati?

Mr. Miller—I could not tell you that. I imagine though probably not to exceed one-half.

The President announced that the next subject for discussion would be on

THE BEST WAY TO EXTEND GAS MAINS INTO NEW SUBURBAN TERRITORY, OR NEW ADDITIONS, AND THE BEST WAY TO REINFORCE INSUFFICIENT PRESSURE IN A CERTAIN SECTION OF A CITY.

The first communication on the topic was presented by Mr. John Franklin, of Cincinnati, O., as follows:

Replying to the request of your worthy Secretary, to add my mite of personal knowledge regarding the subject in hand, I will endeavor as briefly as possible, with the limited space of time I have, to answer the above questions as completely as possible, to the best of my ability under the existing circumstances.

During the closing year of the Nineteenth Century it was my pleasure to formulate plans, and superintend the extension of 168,000 feet of mains and services, to and throughout 5 suburban villages surrounding the city of Cincinnati. Three of these villages were lighted and equipped with boulevard, incandescent gas lamps. In the other two, mains were extended for private consumption only; said villages being lighted by electricity. The following data will explain the system of introducing and extending mains and services to and throughout suburban villages.

General Remarks.—The first and very important part is to take a careful bird's-eye view of the contemplated surroundings, not overlooking the main feature, "That of future development." Then interest the resident property owners and tenants, by a personal introduction to them, urging them to interest themselves as much as possible to bring to bear all the influence they can in urging the village council to action regarding the granting of a franchise to a reliable gas company, for the laying of mains, erection of lamp posts "fitted with boulevard, incandescent gas lamps," and the extending of services for supplying the public with that ever ready commodity, lighting, cooking, labor saving gas.

This may appear comparatively easy, but you will find at times overwhelming obstacles, which you will meet from time to time before you reach the desired goal. Don't give up the fight! But follow closely the line of thought which the following message reveals:

"Perseverance, backed by nerve, and a will that cannot swerve,
Will succeed, though steep may be the hill you climb.
If you are seeking for a name, throw your heart into the game,
And you're bound to be a winner every time.
Keep your nervy fires alight! push ahead with all your might!
Toss a laugh to every care that meets your eye.
Whistle up a merry song as you slowly plod along,
And you're bound to reach the summit bye-and-bye."

If success crowns your efforts, then you are thrown entirely on your o ources to complete to a successful end the furnishing of gas for lighting and domestic purposes.

General Survey.—Arrange for a general, systematic survey of the contemplated territory and its surroundings, platting on map, 200 feet per inch, showing the avenues, streets, byways and resident property, designating the houses along each thoroughfare. Make a careful observation as to the class of residents and probable consumption of gas that would be used by them for lighting and heating purposes, also looking ahead for future development. Calculate for the size of mains and main feeders that would be necessary for the immediate and future demand. Then make arrangements by platting in a small journal each street, designating the houses between intersections, also leaving the opposite page for the names of owners, tenants, agents and necessary remarks, regarding their definite answer either for or against becoming a consumer.

Sowing Seed.—Arrange to get a good, wideawake, energetic young man, one of good personal address and appearance, having sufficient knowledge of the general routine of the gas business, regarding the cost of piping houses, alterations and extensions, approximate cost of ordinary fixtures, gas stoves and general run of gas appliances, their utility and probable consumption and cost per month, as also cost of extending the service from the curb line of the street to the meter, and a hundred-and-one questions regarding the general run of the business.

Furnish your solicitor with application blanks to be signed for the insertion of a service by the owner or agent of the property. Also, have him leave on premises a blank application to be signed by the parties wishing to use gas, leaving also rules and regulations of the company. Inquire at this time the name of owner and tenant, and then make note of same on opposite page of the platting book designated for this purpose. By the time your solicitor has visited every house in the village, and left the blank applications with the accompanying rules and regulations, he then retraces his steps, commencing at the first house he visited, gathers up the applications, making note of those that have signed and those that have not, finding out the particular objections of those not signing. By the time you have gone over the territory a second time, start out for the third time to override the objections, bringing into play all the persuasive eloquence you may be gifted with to gather up the remaining fruit of your labors, remembering that the results gained are the keystone to your future success, which is clearly portrayed by the fact that just as soon as you get the majority of the residents' signatures, the balance follow like a flock of sheep behind their leader. After the solicitor looks back over his field and feels positive that he has gathered up all of the available timber, then his records should be turned over to the superintendent of distribution for analysis. Then start him out for fresh fields to conquer. After the superintendent has carefully weighed and considered the conditions regarding the investment, number of feet of main required, size of main feeders, as also the size of lateral connections, in conjunction with the number of signed applications to the amount of main pipe required, "allowing," providing the village is to be lighted with gas, 125 to 150 feet apart to a consumer. If you are not lighting the village, allow from 75 to 100 feet of main to each consumer, unless otherwise stipulated in ordinance.

Preparation.—After it is definitely settled to extend the mains to supply a certain village, the pipe, fittings, drip-boxes and lamp posts are then ordered, accompanied by a plat giving directions when and where to deliver them, designating which side of street the pipe is to be delivered and which way the pipe is to be placed. This is done in order that the teamster delivering the pipe will lay the pipe on the opposite side of the street from that in which the main is to be extended, hubs of pipe facing in the same direction in which the pipe is to be laid. This saves considerable time and labor in handling when ready to extend. Laying pipe on opposite side of street saves tramping over the metal thrown from first course of excavation made, thereby preventing the metal being scattered throughout the trench. After the main pipe and fittings have been delivered, order out your service pipe, lead, yarn, coal, rubber bags, bladders, lead kettle, service cocks and street boxes. When ready to start, gather together your mechanics, yarners, caulkers, joiners and laborers, and prepare to forge ahead to a finish.

Trenches.—Before opening trenches take minute bearings for your levels, water mains, sewers, crossings and other obstructions, avoiding as much as possible the aforesaid, endeavoring at the same time to lay your main on the side that is most improved, to avoid crossings for house service connections. This occurs only when you find it does not justify you to lay main on both sides of street.

Stretch out your street lines, allowing about 3 feet between center of trench to curb line. If you are going to lay considerable main, say 4 inch, 6 inch, or 12 inch, 50 laborers, 2 pipe handlers in trench, 1 yarner, 4 caulkers, 1 lead joiner, and 1 blocking man will be sufficient to start your laborers. Be prompt in starting on time, as this is a a very essential point. Make out tracing line for a distance say 600 feet, holding your best men at the rear. After you have given lines for width of trench laid out, start your men taking off the first metal, placing said material next to curb on side you are laying your main. After all the metal has been removed, start to excavate, throwing the earth on the outside or opposite line of the trench. Give each man a section 12 feet long, 2 feet wide and 3½ feet deep As fast as they get a section cut down to grade line, move them forward. In this way, "providing the digging is fair," each man can cut out 3 sections for a day's work of 10 hours, which, at that rate, would be 1,800 feet a day. Note carefully when you are down to about the required depth; take your levels at bottom of trench, so that your grade of trench bottom will conform to grade of main to be laid. This insures your pipe being laid for its full length on good, solid foundation, thereby requiring but little blocking to bring it to grade line, also allowing no chance to trap or break by weight of traffic. In cutting out for caulking room be careful to block up your spigot ends.

Placing your best laborers in the rear allows you to begin work of laying main much sooner than if you had to wait until the entire trench was down to grade. After pipe is laid, leveled, lined, caulked, blocked and tested, start your men that are probably cutting out their second or last section in front, back to the rear to fill in the trenches, retaining your best men cutting out sections in front. Fill in your trenches to a depth of 12 inches, then turn your water into the trench, providing you have any, and keep filling in trench. This will cause the material to be thoroughly carried under the entire line of pipe and fill up any recesses that may have been opened out. While flushing, have 6 or 7 men go forward and back with bars, opening up flushing holes so as to allow the water to seep through and follow closely the line of pipe, carrying with it the loose dirt and depositing it around the pipe. Fill up your trench, until the back filling is even with top of trench, then shut off water and allow trench to stand over night. The following morning, if trench has thoroughly settled, fill in again as much as you can, using your rammer. Tamp well and then fill up within 4 inches of the top. Then throw in your macadam and continue tamping as you go along. By the time you are about through you will find but a small amount of material left on the street to be carted away. If there happens to be no water, fill your trench, gradually tamping every particle of material thrown in. This will not insure as good results as flushing, it proving at times necessary to refill and retamp in some places along the line.

Laying Mains.—In the introduction of mains into new territory, when you commence, start from a given point as near to your live feeder as possible, to allow you (when the final connection is made) to connect the mains together with spigot ends facing each other, using a sleeve to make final connection. Do not attempt to cover a territory with mains with connections made to main live line, for the reason that if you are extending as feeders 12-inch or 16-inch pipe, you are liable to incur serious accident, as it is almost impossible to keep your line entirely free of gas, which will escape at times around your bags; not only that, but there is a possibility of your bags giving out, if not carefully watched. Don't run these risks. A small leakage of gas, mixed with a certain amount of air in pipe, is liable to become ignited by a spark from a laborer's pick or pipe, or probably the lead furnace being too near to the end of your line, which compound, if ignited, might cause an explosion, and probably cause serious damage. The safest way to lay mains is to leave your connection with the live line until the last. Test the amount of pipe laid each day, which should average, "with the force of men mentioned," as follows: 1,600 feet of 4-inch, 1,200 feet of 6-inch, and 1,000 feet of 12-inch. The above amounts, in my estimation, constitute a good day's work. Test with air pressure of from 5 to 7 pounds, using a 16-inch cyclinder pump. Take registration of pressure on a 10-pound spring gauge. If gauge shows leak, test each joint carefully with brush and a fairly thick lather of soap suds. A few words would not be amiss in regard to the closing of live lines by bagging. Care should be exercised in doing this work. You can get good satisfaction on smaller lines, say from 4 to 6-inch, by using an ordinary beef bladder, as it is much easier handled through smaller openings, say 1 inch, than a rubber bag. In cutting out or drilling holes for bagging purposes do not leave any sharp projections that would be liable to damage the bladders or bags. In bagging your larger mains, say from 16 to 30 inches, cut 3-inch holes, fill up the threads with a little clay, which will add to the smoothness of the holes. If pressure on these mains exceeds $\frac{8}{10}$ths, use 2 bags. After you have inserted the bag into the main, for protection pass the handle of a pick on the opposite side of bag from whence the pressure on bag is exerted. Fasten the neck of the bag to pick handle, allowing the handle to reach the bottom of the pipe, then pump up the bag and cover well up with clay the neck of the bag and handle of pick. Keep the clay moist and watch carefully. If your are encountering back pressure, use another bag placed about 4 feet from the one already installed. When you are carrying an excessive pressure, say $\frac{8}{10}$ths or more, it is advisable to use 2 bags so that you will be doubly protected in case anything should happen to either one.

The laying and distributing of mains require careful consideration, to the end that you must arrange for centralization of your main lines, thereby insuring thorough distribution. In taking off your laterals I do not recommend less than a 4-inch main. Arrange if possible to connect all ends of your lines, thereby giving complete circulation and equalization of the pressure, leaving no dead ends or uncirculated points. If the pressure at the starting point should be $\frac{3}{10}$ths when the heaviest consumption is on, you should calculate to carry the same conditions with small allowance for friction to the farthest end of your distributing line, when the territory is being taxed by consumption. My maxim is to keep up the pressure, and lay mains of such size that they will be adequate for many years to come. If your mains are laid as they should be your leakage will not amount to any more than if you were laying smaller lines. By adhering to the laying of large lines you increase your output and satisfy your consumer as well as yourself. It will then not be necessary to ask the question:

"What is the best way to reinforce insufficient pressure in certain sections of the city."

Before commencing to lay mains, arrange to test thoroughly, by means of a hammer, each length of pipe and fitting before it is allowed to be put in trench. Before testing pipe or fittings place them on wooden blocking to give them resiliency and sound. Rap smartly its entire length; if a bell like sound is emitted it is perfect. If a dull, leaden sound, examine carefully and remove defective part. These defects, such as cracks, are generally found at spigot end by reason of this being the weakest part of the pipe. Examine carefully around the hubs of both pipe and fittings for blow-holes or porous places. Before the pipe is ready to be lowered into trench, pass a wire brush through its entire length to thoroughly remove any obstacle that might be within. Arrange for measurement of service connections so the holes in main can be cut before pipe is laid. Hand the main to the pipe layers. Yarn well, level, block and then level again. Then start your first caulker cutting off the surplus lead, giving the joint its first caulking. Then move him to the next joint, bringing up your second caulker; keep forging ahead, allowing your third and most reliable man to finish and complete the joint. Start some of your laborers, who have finished their sections, cutting out caulking holes, excavating as far as the curb or opening up crossings for service connections to curb line. Put in all house or lamp post connections while main line trench is still open. In grading your main use a 10-foot level with an adjustable scale from $\frac{1}{10}$th to $\frac{10}{10}$ths; never drop grade less than $\frac{3}{10}$ths, which would in rule measurement be about 4 inches in 100 feet. While the line is being graded, plat your levels and distances between ascending and descending grades. Endeavor when possible to descend your grades back to main lines, or to a centralizing point, thereby saving your siphon pumping stations. In placing your drip-boxes, aim to draw from as much territory as you can, as it saves time and proves more reliable. After placing your drip-box in main line, cut and tap a 1-inch hole in its top, to receive a $\frac{3}{4}$-inch socket with thread cut on the outside. Then cut a piece of $\frac{3}{4}$-inch pipe 1 inch shorter than the depth of your box, screw on $\frac{3}{4}$-socket, and paint outside of socket with a little red lead and litharge, which will harden quickly and make a very stubborn joint to unscrew. Screw socket in 1-inch hole tapped in top of box as tight as possible. Extend from socket a piece of $\frac{3}{4}$-pipe to within 4 inches of street level. Pass over this pipe a piece of $1\frac{1}{4}$-inch "no threads," within $1\frac{1}{2}$ inch or 2 inches from top of $\frac{3}{4}$-inch stem. Fill up between the $1\frac{1}{4}$ inch and $\frac{3}{4}$ pipe with heated tar. This will protect the $\frac{3}{4}$-inch siphon stem and add to its life and stability. Then nipple out the stem with a $\frac{3}{4}$ lengthening piece, which is a socket and nipple cast together. When this becomes stripped from the constant screwing on the siphon pump, it can readily be removed and replaced without digging up the street. This brings the siphon stem within 1 inch of the street level when cap is screwed on. Cover this stem with a cast iron top to protect it.

To facilitate the handling of lead, have lead pot and furnace on wheels so you can easily follow your pipe layers as work progresses. I do not approve of coating cast iron pipe, for the reason that it interferes in making a perfectly tight joint. If necessary to cover pipe with a preparation to protect it from electrolysis, all well and good, but do not paint the inside of the hubs or within 6 inches of spigot ends.

In preparing joints use twisted, tarred yarn, well caulked and evenly distributed to the depth of about 1 inch. Be careful that before yarning the pipe is forced well up against the shoulder of the hub, making it impossible to allow the lead when poured to run through and form an obstruction, besides honeycombing your joint. Use for clays a 1 inch square piece of canvas back rubber packing, cut in length to suit from a 3-inch to a 30-inch main. This packing is covered on the outside with a piece of thin flexible steel, 1 inch wide and about $\frac{1}{16}$ inch thick. Drill and rivet on to the packing, then rivet a lug on each end. In making your clays cut your packing 2 inches shorter than the diameter of the pipe. Place the clay around the pipe and draw it together by using an adjustable clamp. Take a small piece of clay and form the mouth to guide the lead when pouring joint. After removing clay you will find a perfectly smooth joint. A clay, if handled properly, will allow you to make about 500 joints before it becomes burnt or rotten. Said clay can be used in any kind of weather, wet or dry. If raining, pour a little lard oil in mouth of clay when the clay is on the pipe. This will prevent the lead from blowing out, like it does with the common puddled clay. In making a joint, allow from $2\frac{1}{2}$ to 3 inches of lead, as it will insure a good joint, if properly caulked.

In ordering such fittings as tees and crosses, don't reduce them, but use the full size. In reducing use a reducer, as it allows you every chance to draw from your main line, providing your laterals are extending with a descending grade; not only that, but it gives you an opportunity to enlarge without cutting out your main line fitting. After you have completed your main line for the day, close up the end of your line by means of a wooden plug, well clayed. Drive a bar in front to prevent its falling out. This will keep the water out of your lines over night. Have a good, reliable man for a night watchman, whose duty it is to take care of red lanterns, prevent accidents, and look after the company's material.

Preparation of Service Pipe.—The process of preparing service pipe preparatory to its being installed, is as follows—this process adds considerable life to the pipe: The surface is thoroughly heated and then dipped in a specially prepared bath of tar, containing turpentine and pure rubber. Place a barrel of tar paint in a cauldron over a coke fire. When boiled, add 1 gallon of turpentine and 1 pound of pure rubber. Stir until the rubber is thoroughly dissolved. Then draw it off into a square, iron trough, 24 feet long, 15 inches wide and 18 inches deep. On the bottom is arranged a steam coil; outside, and directly over it, are the draining racks. At the end of the trough is a specially arranged rack, with adjustable rests for supporting the pipe. At the end of the

rack there are 18 steam jets, placed in such a way as to enter each length of pipe as it lies on the rack. When ready to begin tarring, turn steam on tar tank, which takes about 1 hour for tar to boil. While waiting arrange pipe on steaming rack and as soon as tar is heated turn steam into pipe on rack, which requires about 3 minutes to become heated. Cap and plug each length. Pick up lengths by special hooks and drop into tar tank. Allow it to remain in bath about 5 minutes. While waiting place another batch of pipe on rack. Turn on your steam while waiting, and then remove pipe out of tank and place on dripping rack. Remove your caps and plugs and keep up this process until you have tarred enough pipe to last a season. In figuring up at the end you will find that you have tarred on an average of 350 pieces a day. Keep tar tank well filled and at boiling point at all times.

Installation of Services.—After written application has been made for service, a service plat is made out, giving name, location, size of service to be installed, showing upon plat which side of street the main is on, and also size. The foreman of service men receives plat, and takes his men with him on street car, if necessary. Before going he notifies his driver to stop at nearest storage station, of which we have 5 distributed throughout different parts of the city and suburbs, to get necessary pipe for the completion of work laid out, said system saving time, as well as wear and tear of horses and wagons. The foreman, upon his arrival at premises, makes careful examination of the same, locates the main line of building, endeavoring to install service as close to the line as conditions will allow, avoiding cellar openings, sewer and water trenches, trees and plants, etc. After deciding on best location, he then opens up the street directly over the main, lines out his service trench and then starts his men. After main is uncovered, he buckles on his drilling machine (a machine made by George Light, of Dayton, O., which I most cheerfully recommend). This machine performs its functions thoroughly, drills and taps a good, clean hole, and allows no gas to escape, thereby protecting your men, as also beneficial to the company.

We install nothing less than 1¼ pipe, well tarred, and laid with a good grade to the main. Thoroughly block and connect main by side holes. I do not advocate top holes, for the following reasons: Too easy to become obstructed, too liable to sag and trap, cannot be cleaned out thoroughly, and do not admit of being well blocked. The only occasion for a top hole would be when the main is very deep, occasioned by regrading of a street.

The Best Way to Reinforce Insufficient Pressure in a Certain District in a City.—A reply to the second question asked, regarding the best way to reinforce pressure in a certain district in a city, is problematical. As the conditions existing could be affected by numerous agencies, it is puzzling to one to get a basis upon which to form or come to any definite conclusion in giving specific information.

In the fall of the year I would start out a half dozen good, reliable men to take pressure between the hours of 6 and 7 P.M. (the hours of heaviest consumption), at points along the line of affected districts; as also to take pressure at points along line of general main outside of district in closest proximity of district affected. Then compare the pressures with those at the works. This will show the deficiency and location of the trouble, which might be improved by the following suggestions: See that your mains are clear, and of sufficient carrying capacity to give you volume and pressure when the consumption is heaviest, allowing a trifle for friction. The conditions regarding pressure would be the same on a 1-inch line as on a 24-inch feeder, providing there was no consumption taken off the lines. But if you find that your pressure has greatly diminished, by reason of heavy drag or consumption taken from it, it is due to obstruction or insufficient carrying capacity, and location of your maim feeders. This will apply as well to your laterals.

In order to supply a district it is necesssary to keep up your pressure at the works when the supply is in demand, delivering it to the different districts with large feeders, taking as few tributaries as possible off the line before reaching the outlying districts. If the existing conditions are such that the capacity of the main feeders of the affected district is of such size as to be inadequate for the demand, extend a separate and distinct feeder, allowing no tributaries to be taken off until it reaches the district to be reinforced. This should be extended direct from the largest carrying main which shows the smallest diminution of pressure when when the greatest consumption is on. If this cannot be accomplished, then extend direct from the works. If you have not sufficient facilities to obtain more pressure, increase the capacity of the works.

N. B.—It would be well to figure up the probable consumption during the month of the entire district, then figure out and compare with tabulated volume statistics of the capacity of mains now supplying district.

In conclusion, I wish to express my thanks for your patience and kind attention, but if the few disconnected thoughts afford a basis for discussion, the object of this paper will have been accomplished.

Mr. B. W. Perkins, of South Bend, Ind., read the following communication on the subject:

The plan outlined by Mr. Franklin, as the best way to introduce and extend mains and services into suburban villages and new territory, is about the way I think most people would do it; at least it is about the way we did it at South Bend last spring, when we laid a main to Mishawaka, a distance of 4 miles. We had the choice of 2 routes, one on the south side of the river and the other on the north side. In making a choice, we considered the future rather than the present as giving the greatest possibilities for consumption between the places. Our choice was on the side that had the fewest houses, because it offered the greatest inducements for the future. It had more desirable ground that was not encumbered by steam roads, and more energy was being put into the sale of ground by the owners; it had good street car facilities, and numerous other advantages which the other route did not have.

After selecting the route we made a canvass of the territory, with a view of getting as many pledges as possible, but found that people in most cases were "Doubting Thomases," not caring to sign any contract until the main was laid on their street. We did not let this deter us, however, as we had made up our minds to deliver the gas there, and not "let up" on them until they used it, and our subsequent success and prospects for this summer show that pledges are not necessary in territory into which it is desired to enter.

I might add that Mishawaka is lighted by a municipal electtric light plant, which may account for the lack of pledges. I fully agree with Mr. Franklin that all this may appear comparatively easy, but it takes time and perseverance to get the right kind of a franchise, etc., particularly if you have to secure 3, as we did.

I think about the first thing to be considered would be whether a high or low pressure system should be used. In the case at South Bend we used the low pressure system, because we think in time the territory between the 2 places will be built up solid, and it would not differ from any common extension in town. Mr. Franklin's system for doing the work is the same as we use, with the following exceptions: We have pipe delivered on same side of street that it will be laid, so that after the trench is marked out, the pipe can be rolled up to the edge, and dirt thrown on both sides, which makes a barricade. The width and depth would have to be regulated by the charaeter of the ground and the climate. We find tamping earth under a main in the same manner as railroad ties are tamped into position is better than blocking and flushing, as by tamping every inch of pipe has a bearing.

Two gas bags instead of 1 in pipes 10 inches and larger, are good both for the protection of your men and avoiding the risk of extinguishing the gas in a neighborhood by the rupture of a single bag. We have not found the hammer test for cracks to be infallible, so prefer to have each piece examined by a workman in addition to testing by hammer, and when by the latter, would prefer to do it while it is suspended by the derrick, as you have only one bearing and that by a rope.

In leveling, we have found an architect's level mounted on a tripod, a valuable addition to the one in the ditch, particularly at the street intersections, or when a section has to be left out for any purpose. We have found drip-boxes placed inside of curb line preferable to ones placed in street, as they can be dug up for repairs without cutting into pavement, and the pump pipe can be left above the ground. If the clay used to form the gate in the rubber jointer is tempered with lubricating oil instead of water, it will not harden by the heat of the lead, and will save time and blowing.

We have found that stucco makes an excellent temporary joint for putting in temporary plugs, connecting new mains with old over night, etc. We put fittings full size, but put a piece of pipe into the branches before the reducer, so that when the time comes to remove it, a bag can be put into the piece of pipe instead of the main line. You thus avoid cutting off the main line.

Discussion.

Mr. Whysall—Are we to understand that Mr. Perkins favors swinging the street main into the sidewalk in order to get the drip-box under the latter?

Mr. Perkins—No; I put the drip-box at the curb and connect it with a small pipe.

Mr. Stone—I do not understand, from Mr. Franklin's way of making a service pipe connection to the main, whether he uses what is commonly called a swing or tap into the street.

Mr. Franklin—Run it in perfectly straight. That always gives you a chance to clean it out whenever you want to.

Mr. Stone—We level our trenches a good deal like they level sewer trenches. We run a line with a regular engineer's level, leveling the bottom of the ditch to that line, and then lay the pipe right on the bottom of the ditch. A man can level up 1,200 or 1,500 feet of ditch in an hour or two in the morning and have the stakes all driven. He doesn't have to bother with levelling the rest of the day at all. The bottom of the ditch is dug according to the line laid out, so we do not have to plug or tamp under a pipe, and it has a perfect bearing all the way through. Another thing that I would like to bring up—I have no opinion on it myself—is as to the relative efficiency, cost or availability of cast iron and wrought iron pipe at the present time for street main work. I notice that the gentlemen who have just read papers speak of laying cast iron pipe. Wrought iron pipe I know costs a little more at the present time, but it can be laid faster, and I have wondered, taking everything into account, whether it would not be better than cast iron pipe, and not as liable to break.

Mr. Franklin—I would suggest that the difficulty in laying wrought iron pipe is that it is not of sufficient thickness to insure good connecting service. Then, again, it has not the lasting qualities. The conditions are not always the same, owing I presume to the different character of the soils in which it is laid. I think you will find the life of wrought iron pipe, in soils where I have seen it tried, to be not over 10 years, whereas the life of cast iroh pipe is practically without limit. Another thing; you have the thickness with cast iron pipe that you do not get with wrought iron pipe, which is a very important feature to be considered in regard to tapping.

Mr. J. R. Lynn— In regard to tapping wrought iron pipe, by the use of a swage you can get thickness enough for your thread, so I do not think that is a source of objection at all. You can get thickness enough that way easily.

Mr. Franklin—I do not know where you can find a piece of wrought iron pipe thicker than ¼ of an inch, and for instance, on a 2-inch service, that doesn't allow you more than 3 or 4 threads, which will not be sufficient to withstand the strain of a 2-inch service.

Mr. Lynn—If you swage the hole out, you can get thickness.

Mr. Franklin—If you swage out the hole you weaken the pipe.

Mr. Lynn—Not necessarily.

Mr. Franklin—By swaging you weaken the pipe so that it is difficult to tap into it satisfactorily.

Mr. Lynn—You might use a saddle.

Mr. Franklin—Yes; it is true you can use a saddle.

Mr. Whysall—My experience is that one can get a very satisfactory joint by tapping wrought iron pipe, and it will give you sufficient strength to pull the service pipe apart without the threads pulling out of the mains.

Mr. Neeley—My experience has been in favor of wrought iron pipe, more particularly in natural gas than in artificial gas mains. In regard to its lasting qualities. I have a line in mind now that has been in use for 16 years on which we carried 200 pounds pressure on the line when we have had it, and we have had it a good deal of the time. While we have had to cut out 2 joints in the last 5 or 6 years, eaten up I presume by some alkaline substance in the ground, the rest of the pipe is practically as good as new. My experience with cast iron pipe in several artificial plants that I have had to do with, is that it does not practically last through a lifetime, as suggested by Mr. Franklin, but that it does rust and eat out. I have taken up some cast iron pipe in one or two Ohio and Indiana towns that had been in the ground not to exceed 17 to 20 years, and it would not bear its own weight. I do not know what was the trouble with it, but it was so rusted out and eaten up that you could shave it off with a knife. I believe that wrought iron pipe will last as long in the ground as cast iron, that you can make just as good a tap in it as with cast iron, and just as tight a joint, especially if you tap in the top. If your pipe is not too large (say a 4-inch main), it is a very easy matter to make a top tap and use a swing that will give you a good connection.

Mr. McMillan—I have taken up over a mile of wrought pipe that had been down between 15 and 16 years, and there was probably in that whole stretch about 3 lengths that I could not with the hand dust off and find the original marks on it as to the number of feet in it.

Mr. Dunbar—On page 7 of Mr. Franklin's communication he speaks of a cylinder pump to obtain a pressure of 5 to 7 pounds on the main. I wish he would tell us if that differs from the ordinary cylinder pump, where he obtains it, and his method of using it to keep the end of his pipe tight while he is testing it. He also speaks of a specially prepared tarred yarn, and I want to inquire what kind of tarred yarn he uses.

Mr. Franklin—It was a small, double handled cylinder pump, 16 inches in diameter. An ordinary make of pump; just the same as any ordinary suction pump would be. In testing a line of 1,800 or 2,000 feet we generally put in an iron plug and calk it at the end of the line. In testing we pump up to about 7 pounds and then test every joint before anything further is done with the line, or before any dirt is put in. With reference to the kind of tar used in the preparation of the tarred yarn, I will say that it is simply ordinary tar, so that it makes a good solid packing when calked into the joint.

Mr. Whysall—Isn't it regular jute?

Mr. Franklin—Yes; it is regular jute.

Mr. Lynn—I have taken up quite a good deal of wrought iron within the last few months that was in almost as perfect a condition as it was the day it was put in. It ran through many different sorts of soils and had been in the ground about 18 years. I would state further that I have taken up cast iron pipe that had not been in very much longer than that, and it was in much worse condition.

Mr. Franklin—With reference to wrought iron pipe, I will state to you what I have found from my experience in the Cincinnati Gas Company. We have taken up cast iron mains that were in the ground for 40 years (a pretty long time), to replace them with larger ones, and that cast pipe was in just as good condition as the day it was put down. I have taken out over 1,100 ¾-inch house services in the past 3 years, and I have removed within the last year over 2,000 lamp services of wrought iron pipe. The conditions, of course, in Cincinnati may differ entirely from those where you are. In a gravelly, sandy soil wrought iron pipe will last 15 or 20 years, but with conditions as they are in and about Cincinnati, where the ground is hilly, and where it has been filled up by ashes and other debris, wrought iron pipe will not last longer than 3 to 5 years. As far as the lasting qualities of wrought iron and cast iron are concerned, I think there is a vast difference. You will find that the cast iron will outwear the wrought iron mains three times over.

Mr. Lynn—There is not much comparison between the thickness of a ¾-inch wrought iron pipe and a 4, 6, or 8-inch cast iron pipe. I do not think that Mr. Franklin, in removing any of that cast iron pipe which he found in such excellent condition, ran across any that had been buried in cinders. I had occasion to renew a cast iron connection which ran through a cinder bed, and by the time we got the pipe out of the ground, it actually had fallen to pieces.

Mr. Franklin—Well, of course, conditions may differ in that way.

Mr. Littlehales—My experience coincides with that of the gentleman from Cincinnati very fully. I have found services that had been laid uncoated, entirely and absolutely destroyed in 3 years in some soils, whereas, perhaps a few feet away the pipe would be as sound as the day it was laid. The 2 weakest spots I have always found in services are the points right under the gutter and under the eaves where the water is continually soaking and the pipe is alternately wet and dry. Under the gutter, and under the eaves of a building, are almost invariably the worst points. I take it for granted that no one lays service pipes now without coating them in some way or other, and that, of course, adds very materially to the life. I had occasion to take out, 2 or 3 years ago, many hundreds of old services, and I found them—well, they were curiosities worth keeping as curios, for the extraordinary way in which they had been eaten through; and yet some of those same pipes, a few feet from the worst places, were just as good as the day they were laid, so it would seem that the difference in the soil had a great deal to do with it, and that wrought iron pipe was much more affected by the difference in the soil than cast iron pipe, and that, while you may find it in one place in perfect condition after years, yet 2 or 3 feet away from that you may find it completely destroyed.

Mr. Stone—I went into the matter this spring of wrought and cast iron pipe, because I expected to lay between 10 and 20 miles of main the coming summer, and was in doubt as to the best kind of pipe to lay. I found just about as much difference of opinion as has been expressed here to-day. I wrote to many different people and about half of the replies received favored wrought and the other half recommended cast pipe. I was somewhat surprised at the result. I went to Pittsburg and talked with both Mr. Robert Young and Mr. John Young about the matter. I was very mueh surprised to find that they had changed, and that both were now strong advocates of wrought iron pipe; one of them put forth a reason for using wrought iron pipe that has not been suggested here, to the effect that during the month previous he had had 27 breaks in his main line of cast iron pipe where he had not had one in his wrought iron pipe. He stated the trouble or bother of keeping up the cast iron pipe, owing to breakage, was a great deal more than in the case of wrought iron pipe.

Mr. Lynn—I think anyone will find the percentage of leakage in a good cast iron system will be materially greater than the percentage of leakage in a good wrought iron system. I think such has been the general experience of those who have experimented with both.

Mr. Franklin—One word in regard to that, Mr. President. We have ssomething like 415 miles of cast iron pipe throughout Cincinnati and its suburbs, and our leakage last year was a little over 9½ per cent. I think that is speaking pretty well.

The President—I would like the floor just long enough to say that percentage of leakage does not amount to anything. It all depends upon what you sell. If you do not sell any gas, you have 100 per cent. leakage. (Laughter.)

Mr. Franklin—I had occasion a few days ago to take up a service, at the corner of Fifth and Main streets, in our city, which, traced I think by the records, was the fourth service put down when the Cincinnati Gas Company commenced business, over 42 years ago. It was a ¾-inch cast iron pipe.

The President—Gentlemen, are you all satisfied that wrought iron is the best, and are you all satisfied that cast iron is the best? Any further remarks? This is a pretty important subject.

Mr. Stone—I do not want to do all the talking, but I desire to say that I really think if we lay wrought iron pipe it should be coated with a covering like that described by Mr. Franklin. The main pipe should be coated as well as the service. The cost of coating does not amount to a great deal, and it more than pays in the long run.

Mr. Mulholland—I would like to ask if any of the members have had experience as to whether wrought or cast iron pipe best withstands electrolysis or electrolytic action.

The President—That is a very pertinent question.

Mr. Franklin—Regarding that, I think there is very little difference between either one of them. One is about as liable to be affected as the other. We are not troubled with it in Cincinnati, because our railroad systems there are of the double trolley type. In the suburbs, though, we do encounter some difficulty of that kind. I remember one instance where there was a single trolley system, our cast iron pipes and the services were eaten out.

Mr. Mulholland—My question was which, if either, best withstands the electrolytic action. Suppose two parallel lines were subjected to the same amount of current or voltage, which kind of pipe will best withstand the electrolytic action?

Mr. Franklin—I still stick to the cast iron pipe.

Mr. Lynn—If there is any advantage in that regard in respect of cast iron pipe, I think it must be due to its extra thickness. I cannot see any other reason.

Mr. Whysall—I understand the proposition to be that we have two parallel lines supposed to carry gas, but part of the time at least are carrying electricity. The cast iron pipe having the greater cross section will probably carry a greater amount of current, but the lead joints are an obstruction, and when the current passes from the hub to the spigot and jumps through the lead there is quite a resistance. The result is that the lead tears out, and in several instances an analysis of the soil removed from around the joint indicated the presence of considerable lead, and that would be also substantiated by the fact that the lead in the joints was loose.

Mr. Lynn—I think water companies are having about as much trouble with their lead services as we are with our mains from the electrolytic action.

The President—Anything more? We have a query in the Question Box that is very pertinent to this subject. It is

> Question No. 7.—"What is the best coating for services and main pipes?"

I think that question may very properly come up for discussion at this time. A great deal of what has been said about electrolytic action, I think, depends upon the specific conditions of particular cases. There are so many conditions which affect the results of electrolysis that unless you know the specific conditions it is very hard to draw any conclusions which are at all valuable from any reported observations.

Mr. Littlehales—I would like to say, so far as my experience is concerned, that the best is impracticable on account of its cost. I believe the best is red lead. I have tried that very extensively. I find it a long way ahead of anything else I ever tried. Following that I presume would be the bituminous coverings. The bituminous covering I suppose is the best practicable coating. You should try to get the tough quality rather than the brittle, just keeping it below the brittle character. I believe, however, the best of all coverings to-day is red lead, from my personal experience.

Mr. Franklin—I have a reference here in my book stating that asafetida is quite a preventive of electrolsis. I never have had occasion to use it, but I have a memorandum here of it in my manual.

The President—I never heard of that before.

Mr. Franklin—I suppose that refers to asafetida paint?

The President—I think Mr. Littlehales suggestion about red lead has one disadvantage. Its conductivity is greater than tar, or paraffine, or anything of that sort, and there would be a greater protection from electrolysis by the use of a compound of high insulating quality.

Mr. Stone—Would not good coal tar make good coating for service pipes and pipes of that character. If applied hot and if a thorough coating were given to the pipes, would it not make a good coating?

Mr. Franklin—This preparation is one of coal tar, turpentine and rubber. The object of the latter is to make it elastic and stick to the pipe, or to make it adhesive.

The President—Rubber has a very high resisting quality. The object of it I presume is to make the coating elastic.

Mr. McIlhenny—I think general experience has taught, as well as individual experiment, that coal tar, if used upon iron of any kind should be heated, not necessarily to the boiling point, but to the degree necessary to expel the small quantity of ammonia which it always carries, and lime or some other alkali should be used to neutralize the acid present. There is a certain percentage of carbolic acid in crude tar. If sprinkled well with powered lime, we make the tar a little bit thicker as well as neutralizing at the same time the acidity. I have known of iron coated with crude tar to rust out very rapidly, but where the tar had been treated with lime that acidity had been corrected and it was all right.

The President—I have been requested to ask Mr. Stone what the effect was when he turned natural gas into his artificial gas mains at Ashtabula, owing to the difference in pressure.

Mr. Stone—Might I inquire if you refer to the effect on the mains, or the effect on my consumers? (Laughter.)

The President—Well; tell us all about it.

Mr. Stone—I did not notice any difference so far as the mains, services, or meters were concerned; that is, if I did not wish any consumer to use any larger quantity, I do not believe I would have needed to make any change at all. I did not notice anything of that kind; but as far as the consumers were concerned there was quite a difference. As you know, natural gas is of lighter specific gavity than artificial gas, and the higher pressure given made it so that it went through a hole a good deal quicker. We had a large gas stove consumption, a number of open tips, and a large number of Welsbach lights. The gas stoves all smoked, and with the Welsbach lights the blaze going through the chimneys broke them. The open flames hardly gave any light, and the consequence was when the change was made, we had to start several gangs of men over the town, each one taking a different route and adjusting things as he went along. For several days we did nothing else but adjust gas stoves and Welsbach lights, and tried to instruct the people as best we could in regard to the uses of the new fuel. Outside of the trouble with our consumers I did not experience any at all.

Mr. Dunbar—The gentleman stated that natural gas, being of lighter specific gravity than coal gas or artificial gas, went through an opening faster. I would ask if that more rapid flow was not due to the increased pressure rather than the lighter specific gravity?

Mr. Stone—I think both had something to do with it; I think both were responsible.

The President—Give them the law.

Mr. Stone—I do not understand you.

The President—Would not the law be that the flow would increase as the square root of the pressure, and inversely as the square root of the gravity?

Mr. Stone—Certainly; but I did not understand your question.

Mr. Andrews—What pressure did Mr. Stone carry on the lines after he made the change.

Mr. Stone—Of course, we knew we were going to turn the natural gas into our mains, so, in order to get the people as near ready as we could, we increased our main pressure to 30-tenths on the old coal gas. We carry 6 ounces on our lines in town at the present time, which would be equivalent to a little better than 10 inches.

Mr. Dunbar—Is not the specific gravity of natural gas much greater than that of artificial gas? About 95 per cent. of natural gas is marsh gas, CH_4. The combined molecular weight of marsh gas is 16. About 45 per cent. of coal gas is hydrogen, which would make a ratio of about 16 to 2 in favor of natural gas as having the heaviest specific gravity. About 40 per cent. of coal gas is marsh gas, so it would seem to me that

natural gas would have a specific gravity of 30 or 40 per cent. greater than artificial gas.

The President—What is the specific gravity of natural gas, which is largely marsh gas? Do you know what the specific gravity is?

Mr. Stone—I do not know.

Mr. E. E. Eysenbach—As a matter of fact, the specific gravity of natural gas is greater than that of coal gas.

The President—What is the specific gravity of water, coal and natural gas?

Mr. Eysenbach—Natural gas is between 5 and 6-10ths; coal gas is between 4 and 5-10ths.

The President—I think water gas will go over 6-10ths, and natural gas to about 5½.

Mr. Eysenbach—Pure carburretted water gas would not be any lighter than coal gas.

The President—What do you say as to the relative specific gravities of water, coal and natural gas, Mr. Shattuck?

Mr. Shattuck—Water gas, .650; natural gas, .502; coal gas, .420.

Mr. Dunbar—I made a calculation the other day of specific gravity of coal gas and was surprised to learn that it did not go to 4. If my calculations were correct, the figure was below .390. I took the gas as Mr. McMillan analyzed it, and in calculating the flow of gas through pipes in the formula, the specific gravity I had used was .420, and in a place where it was illustrated by calculation a specific gravity of .390 was given. Then I calculated it and found that .390 was about correct.

The President—Mr. Eysenbach, have you not had some experience along that line?

Mr. Eysenbach—I have seen it given all the way from .36 to .42 for coal gas.

The President—By analysis it will come close to .420. I think if Mr. Dunbar will not calculate it, but will measure or weigh it, he will find it will go very close to 4½. I do not state that as a positive fact, as I have not done any work of that kind for a long time.

Mr. Lynn—I may state that it may vary with the amount of air that is in it.

The President—It will vary with the amount of water vapor, too, I think.

Mr. Lynn—I do not think water vapor is generally specified in the analysis.

The President—Can anybody tell us what it really is?

Mr. Whysall—I had occasion to test the specific gravity of our gas some time ago, and I found that at the highest and heaviest it was .509.

The President—That was for coal gas?

Mr. Whysall—Yes, sir; 18-candle power.

The President—How low does it go?

Mr. Whysall—It runs as low as .485.

The President—And how much of that was CO_2?

Mr. Whysall—Not very much.

The President—It must have been a good deal.

Mr. Whysall—The natural gas in this district runs about .650, and if you adjust a Welsbach lamp to a 20-tenths pressure with artificial gas and attempt to run the same lamp, and get the same degree of light with natural gas, you have to cut your pressure down to about 15-tenths.

The President—Gentlemen, this may not come with very good grace from the chair, but I would suggest that we ask Messrs. Shattuck, Whysall, Eysenbach and Dunbar to report to-morrow on the specific gravity of coal, water and natural gases. I will appoint them as a committee to make a report on that subject to-morrow.

Mr. Littlehales—I have made a great many examinations by the effusion test and found coal gas, when there was no CO_2 present, to run from .420 to .430. I have made as many as a score of tests by the effusion method.

Mr. Barnes—I think we are drifting away from the information that the gentleman was seeking. I think his trouble was due rather to the insufficiency of air, owing to the fact that artificial gas of the same volume requires much less air than natural gas to create the same efficiency of combustion. I do not think the relative specific gravities would change the flow materially, but the openings of air in his mixers would cause smoking and trouble rather than the increased quantity of gas.

The President—Gentlemen, we do not want to cut anybody off on this discussion, but if there are no more comments on this subject we will go to the next paper, which is a discussion on

THE EQUITY, LEGALITY AND ADVISABILITY OF CHARGING DIFFERENT RATES FOR ILLUMINATING AND FUEL GAS;

the written contributions thereto being from Messrs. Emerson McMillin, Paul Doty and Henry L. Doherty. We have with us this afternoon an old performer whose face was very familiar to the members of the Ohio Gas Light Association some 8 or 10 years ago, in the person of Mr. Martin A. Gemuender of this city. He has appeared before this Association a number of times when he was engaged in the gas business, but now he is a politician. I will ask him to read the discussion of Mr. Emerson McMillin. We asked Mr. McMillin for a discussion on this subject. He said he had written his views to the Mayor of Detroit and gave us permission to print what he said on that subject at that time if we so desired. Upon reading it over we found it covered the subject very fully, so we have accepted it as his contribution.

Mr. Gemuender—Gentlemen, I do not like to read anybody's paper unless I have had a chance to look it over beforehand because a great deal depends sometimes upon the inflection you put upon a sentence in order to get its meaning.

Mr. McMillin's discussion on the subject was then read, as follows:

From Mr. Emerson McMillin to the Mayor of Detroit—Clippings from the newspapers published in Detroit have been sent to me, in which it is stated that you deem it your official duty to see to it that the Detroit City Gas Company does not charge two prices for its gas. I write to you now on the assumption that these statements are substantially true.

Whether the provisions of our city franchise providing for two prices are legal or otherwise, they are at any rate what the city demanded, and whether legal or not can only be determined by the courts. I desire, however, to call your attention to a few facts bearing on the question that to me seem to warrant the two prices.

First: It has been the practice for most of the cities of this country for many years to make a different price for gas used for fuel from that charged for gas used for lighting. It being customary to do this of course does not make it right, but it is reasonable to assume that if it is demanded by the public, and conceded by the gas companies, it must be mutually beneficial.

During the first half century of gas lighting prices for gas were—compared to present prices—very high, and yet the business was not more remunerative than other classes of business in which men were generally engaged.

The limited sales required that the gas be sold at a high price in order to pay an interest on the investment in plant. It was obvious that the only feasible way of reducing the price, without loss, was to increase consumption. But increased consumption meant increased investment, unless some means were found for increasing capacity of existing plants. This desideratum has been secured through the encouragement of the use of gas for fuel, chiefly for cooking.

Only a few years ago nine-tenths of all gas consumed was sent out during the first three hours of the night, but little during other hours of the night, and practically none during daylight. With a plant, holders, mains, meters and services of a capacity of supplying one million feet per day, under old conditions, there can now be distributed two million feet per day. Again, the plant of a gas company must have a capacity in excess of the maximum winter demand. This demand used to be 4 times the quantity demanded in summer. But fuel gas is used chiefly in summer, and this new business is gained with but small additional investment. This change in capacity has been the principal factor in enabling gas companies to reduce the figures at which they can afford to sell gas.

In this respect the gas business does not differ materially from other mercantile undertakings. If a drygoods or grocer merchant was compelled to keep open 24 hours each day, and sell goods but 3 or 4 hours, the cost incident to the conduct of his business would be greatly increased. Gas companies are now enabled to use their plants practically all the time, the noon hour often being the hour of largest consumption.

Apparently parties agitating this question are under the impression that the two prices inure chiefly to the benefit of those most able to pay. The reverse of this is true. Well-to-do families will pay from 2 to 5 times as much for their lighting gas as their fuel gas, while thousands of small consumers will pay more for fuel than for lighting. In fact, in nearly all the cities where the writer is interested in gas, the companies go to the expense of piping the poor man's cottage, where fuel gas is used, in order that the occupant may have gas light as well as gas for fuel—the company being compensated, in a measure at least, by thus increasing the revenue to be derived from the investment made in laying the main and the service pipe to the man's residence.

Hundreds, and possibly thousands, of laboring men in your city have asked for fuel gas, who did not feel able to pipe their houses for the use of illuminating gas; many in fact use gas for cooking who do not feel able to light with gas, even if their houses are piped for that mode of illumination.

It is not the desire of the gas company to discriminate, but if the adoption of such systems as years of observation and experience have determined to be advisable should make apparent discrimination, we I trust are all agreed that it should be, as in the present instance, in favor of those least able to pay. The fact is, however, that the same prices are given to every consumer—$1 for lighting, 80 cents for fuel, and 60 cents for gas engines. The franchise ordinance does not require us to sell gas for power at 60 cents, and consulting our own direct interests we should decline to make the concession. But men have made investments in gas engine power expecting to use natural gas. This they can no longer obtain. We have felt it our duty to assist them all we can to utilize their plants. Some others who could never get natural gas claimed we ought to help them by giving them cheap gas, in view of the fact that we could not afford to lay natural gas mains to their premises. We try all we can to meet the views of our patrons. Indirectly, whatever assists the manufacturing interests of Detroit assists the gas company, and we have acceded to their requests. Does this do injustice to the general public? We think not. We do not charge more to others by reason of this concession; while, on the other hand, gas engines being larger users of gas materially increase our output, and hasten the time when under the terms of our ordinance we would have to reduce the price to all consumers.

To read publications now being made one would infer that we had been surreptitiously charging two prices; while the ordinance of the city during the past 8 years has required this, and nearly half a million bills sent out annually from the gas office have carried on their faces the evidence of such fact.

I believe no one can truthfully charge the gas company with a failure to faithfully carry out all the conditions imposed by the city franchise It deserves no special credit for this. It entered into those conditions with its eyes open, and after long discussion. It has in the last 3 or 4 years expended $1,500,000 in improving and extending its plant, putting in nearly double the amount of money it has taken out through the payment of interest on its bonds and a few dividends on the stock. It now pays about double the amount of taxes it paid before the present franchise was granted. It has done all in its power to satisfy its customers and the public authorities. Coal and oil, out of which it must make gas, have nearly doubled in cost, yet it has not asked a raise in price.

Quasi-public corporations should be held to rigid observance of their contracts and obligations with the public. Is it possible that the obligation to live up to a contract should apply only to one party?

The President—I will ask Vice-President Andrews to take the Chair while I read Mr. Doty's paper. I feel I am taking rather too prominent a part in this programme, gentlemen, but I have had requests from 6 other Associations in the last year for contributions, but I had not the time to give any of them any contributions. The only reason I am taking such an active part in some of these discussions is because I think they are very important to the gas industry. In addition to the paper just read as coming from Mr. McMillin, we solicited the views of Mr. Paul Doty, of Detroit, who had just been attacked by the municipal authorities of that city, and who I thought had occasion to go into this question more thoroughly than almost any other man in the country.

In reply to my request Mr. Doty sent the following letter, which he afterwards consented should be used as a contribution on this subject:

From Mr. Paul Doty to Mr. Henry L. Doherty: I thank you for your letter and kind invitation, and as requested I have sent to St. Paul my reply by wire. The telegram reads, "Regret am obliged to decline invitation to discuss subject suggested." I am obliged to do this for the reason that affairs in Detroit are so strenuous I feel I cannot give the time the subject demands.

My own opinion is, as you know, in the present state of the art, there should be no discrimination in price. If a discrimination be made it should be regarded simply as business expedient, and whether public service corporations can make business expedients or not legally I do not know. I do know, of course, that such discriminations have been made, and made very generally, but the fact that they have been made may or may not make them right in the eyes of the law. Custom largely governs our actions in life, and as "Use is the law of language," so custom may be the law of business.

Gas for fuel is no longer an infant industry, and needs no protection. Gas for lighting is a reviving industry, and I think needs the encouragement of at least having for its price the same rate as gas for fuel. There is this to be said, however, the fact that we have hitherto offered a lower rate for gas for fuel came from our ability to make this lower rate depending upon the fact that we received a higher rate for gas for light. You know we sell gas for power at 60 cents per 1,000 in Detroit. I regard this price as simply a business expedient. Our ability to sell gas at 60 cents for power is due to the fact that we get 80 cents for fuel and $1 for light. I told a reporter who asked me why we sold gas at 60 cents per 1,000 that we could afford to sell some of our gas all of the time for 60 cents, and all of our gas some of the time for 60 cents, but we could not sell all of our gas all of the time for 60 cents.

Strictly speaking, if a public service corporation must give absolute regard to equity before the law, then all of the business expedients, such as discount for prompt payment, discount for quantity of consumption, or discount for nature of service, or for any other cause, must give way.

The President then read the following contribution to the subject under discussion:

There seems to be a growing tendency towards the belief that we should sell all of our gas at a uniform price per 1,000 cubic feet to all customers, and regardless of the quantity of consumption. The sale of gas at a uniform price per 1,000 cubic feet is unquestionably inequitable, and equitable charging can only result from charging on the same basis as our costs. Our expenses are influenced by:

A. The number of consumers or meters we have.
B. The location of these consumers.
C. Their maximum demand.
D. Their consumption.

Expense A is a fixed cost unaffected by the quantity of consumption, and should be charged regardless of consumption. It is made up of investment expenses, expense of reading meters and maintaining meters and services, and cost of bill making and collecting.

Expenses B and C are similar to A, but are made up more largely of investment expenses.

To be equitable, a flat charge for "readiness to serve" should be made, based on these fixed expenses, and then gas should be charged at a uniform price per 1,000 cubic feet sold. A similar system to this is used by some electric companies, and the electrical fraternity have give this question of rates much consideration, and I predict that in 10 years every electric company will have ceased to charge for current at a uniform rate per kw. hour.

I have tried to find some way to equitably apply this system of charging to the gas business, but have not yet been successful. I cannot admit that any other system of charging would be equitable, but I believe differential rates for fuel and illuminating gas to be more equitable than a uniform rate.

I can pass no opinion of value on the legality of such discrimination; but I would have little fear of any of the higher courts declaring such a differential illegal, if the case were properly presented. I firmly believe that such discrimination is advisable. To sum up the opinions as set forth above, I believe:

1. That none of the systems of charging for gas that are now in use are equitable.

2. That a lower rate for fuel gas is more equitable than a uniform rate.

3. That differential rates between gas used for fuel and illuminating purposes would be sustained by the United States Supreme Court, if properly presented.

4. That such differential rates are advisable.

To support my first position, I will assume that you will all agree that our expenses depend on the uniformity of our sendout; that is to say, our cost would be a minimum per 1,000 cubic feet if our sendout were absolutely uniform for each hour of the year. I think you must all agree on this broad ground, and having admitted this, you must then admit that the nearer we approach this condition, the nearer will we reach our minimum cost.

To support my second position, I must demonstrate that the use of fuel gas tends to bring about the condition favorable to minimum cost prescribed in my first position. I think you must all agree that development of the fuel market to the present extent has given us a higher average load compared to our maximum load than was obtained when nearly all our gas was sold for lighting purposes. If necessary, I think I can demonstrate this point to your entire satisfaction. Expenses, in the sense I am using them, must include both operating and fixed expenses. If our gas at Madison, Wis., were all sold for illuminating purposes, it would so increase our maximum demand that our mains would have to be of a size to yield nearly 3 times their present conductivity. Our sendout there has been so uniform throughout the 24 hours of the day, that we have been able to get along with a holder capacity of about 33 per cent. of our maximum day's output without serious inconvenience. Our difference in price between gas used for

fuel and illuminating purposes is 25 per cent. per 1,000 cubic feet, and we think our expenses, including interest and depreciation on the additional equipment demanded, would equal this difference, if we were selling all our gas for illuminating purposes. In addition to this, few of us could sell illuminating gas with the same degree of profit if our fixed charges were not partially supported by our sales of gas for fuel purposes, and such sales of gas for fuel purposes would be considerably less if we attempted to sell at our maximum price, or even at the price which we now average.

My third position is based on the view the courts take of discrimination in railroad rates. Every argument which can be made for the sale of gas at a uniform price per 1,000 cubic feet can also be made to support the contention that railroads should charge a uniform rate per ton mile, regardless of the length of haul or the class of freight. The Interstate Commerce Commission, a national board of control, not only countenances discrimination in railroad freight rates but counsels it. How can the United States Supreme Court support discrimination by one quasi-public corporation, and refuse it to another, when both can be measured by the same reasoning.

My fourth position is based on competitive conditions, and for comparison we must reduce gas and all competitive commodities to a uniform measure of light and heat; namely, the candle power hour and the British Thermal Unit. I will therefore assume the following money and energy values: Gas, $1 per 1,000 cubic feet; soft coal, $4 per ton; electric current, 10 cents per kw. hour; hard coal, $8 per ton; kerosene, 10 cents per gallon.

Gas burned in open tip, 3-candle power hours per foot, horizontal measurement.

Gas burned in incandescent burner, 20-candle power hours, per foot, horizontal measurement.

Kerosene burned in good lamp, 600-candle power hours, per gallon, horizontal measurement.

Electrical current, glow lamp, 3.5 watts per candle power hour, horizontal measurement.

Electric current, open arc, 1 watt per candle power hour, spherical measurement.

Electric current, inclosed arc, 1½ watts per candle power hour, spherical measurement.

Gas	650 B.T.U. per foot.
Kerosene	150,000 B.T.U. per gal.
Soft coal	30,000,000 B.T.U. per ton.
Hard coal	27,000,000 B.T.U. per ton.
Electric current	3,411 B.T.U. per kw. hr.

Relative Cost per 1,000-*Candle Power Hours.*

Gas, open tip	33⅓ cents.
Gas, incandescent burner	05 "
Kerosene	16⅔ "
Electric current, glow lamp	35 "
Electric current, open arc	10 "
Electric current, inclosed arc	15 "

Of course, electric current is often sold for less than 10 cents per kw. hour, and especially for arc lighting, but arc lighting has serious limitations, and has never been a competitor, except for certain classes of illumination. Gas at $1 per 1,000 cubic feet, if used in incandescent lamps, is an unassailable competitor as far as economy is concerned, and if the gas company would furnish incandescent lamps and supplies free, gas would still be the most formidable competitor in lighting from the standpoint of economy, even if sold at $2 per 1,000 cubic feet.

Relative Cost of Heat per Million B. T. U.

Gas	$1.54
Kerosene	.66
Soft coal	.133
Hard coal	.296
Electric current	29.02

Gas at any ordinary selling price is a competent competitor for lighting, and virtually the whole lighting business is at the gas company's command, as far as economy is concerned; but is it not apparent that every decrease in the price of fuel gas opens up a larger field of possible consumption, and generally with a profit of everything above your operating expenses? Let us assume that our sales of illuminating gas are so meager that we would have to get $2 per 1,000 cubic feet, if we had no other business, and at this price we could sell no gas for fuel purposes. Our interest charge in this case might be $1 per 1,000 cubic feet. Now let us assume that we could double our sales of gas by making the rate of $1.25 per 1,000 cubic feet for fuel gas, and that the 25 cents profit on these sales for fuel purposes would enable us to reduce our price on illuminating gas to $1.75. Surely the illuminating gas consumer has no just complaint, and while the average price would be $1.50 per 1,000 cubic feet, I think you will all agree with me that if we sold all our gas at a uniform rate of $1.50 our profit would either be less, or else we would have to get a higher price for our gas, as a rate of $1.50 for fuel would curtail more fuel gas business than this rate would create illuminating gas business. I believe that the greatest profit can be made by a marked differential rate in favor of fuel gas, or that the same profit can be secured by differential rates which average less than a uniform rate which would yield the same profit. The Interstate Commerce Commission advise differential rates on this very same line of reasoning, and economists generally support their position. I, therefore, conclude that differential rates for illuminating and fuel gas are *legal* and *advisable*, and that such a differential is more *equitable* than a uniform rate.

[To be Continued.]

[Prepared for the JOURNAL.]

Submarine Oil Wells of the Pacific Coast.

By ENGINEER.

Methods of Operation.—The operation of the submarine oil wells, at Summerland, Santa Barbara, Cal., and those wells of other portions of the Coast line which are classed under the head of submarine wells, presents an interesting matter to readers. Your correspondent visited these wells recently and was surprised at the advancement which had been made in the work. A few years ago, when I was here, there hardly anything had been done towards getting the petroliferous products from the submarine wells. At the present writing hundreds of derricks are in erection and in process of working, carrying the oil-drilling and operating rigs for getting the valuable deposits from the bottom of the sea to the surface. These derricks are constructed chiefly of wooden beams, and are pretty much on the same plan as the usual American design. At one locality these derricks extend about as far as the eye can see, and the rigs of the various workmen are quite close together. Some of the derricks are quite inshore, and easily reached. Others extend out into the water and are accessible only by boat, or on long wharfs which have been put in for the purpose. The derricks are usually built higher than the land derrick, so that the extra length of posts may make up for the space or depth of water and leave the usual working space above the water line.

The Oil Wells.—The petroliferous oil deposits may be found under varying conditions in the bottom of the sea at the points at which the oil well engineers are now working. Sometimes this oil deposit is in the form of a chamber of oil and gaseous matter, which, when tapped, shoots forth in volumnes to the water level, where it may be secured by using specially designed catch-pans. The view in Fig. 1 is intended to represent one type of oil well of the submarine character. This well exists under the water line at distances varying from 100 to 500 feet, sometimes more. The water line is first traversed by the drilling tools and then the sand deposits are entered into. Sometimes the oil chamber or pocket is tapped almost immediately, while at other times it is necessary to bore for many days. The petroluem oil and gases are frequently located confined within a stony chamber, as represented at *C*. It is only required to tap this chamber to free the contents. In order to get all of the oil and gases freed and floated to the water line, various types of explosives are used. If the pocket is productive, the exploding cartridges are not used; but if the discharge of product is low, or that of a once paying well has declined, then the exploding devices are utilized to loosen the surrounding strata and permit the obtaining of all the oil in the fissures. Thus, a well boring which has about played out is made to become productive again for a brief space by getting out of it all there is in the adjoining strata. The explosives are usually cartridges of nitrolycerine, lowered by means of a cable *A*. The cartridge is marked *B*. The cartridge is exploded at the right time and the rocky masses and sands are broken and scattered and new pockets of oil opened. In this way consideralbe oil is secured from a single boring.

Series of Drillings.—It is the custom to operate in a series of holes for one boring. This is illustrated in Fig. 2. The tube which is employed is marked *D*. It is sunk into one of the finished drillings as shown, and operations begun. In the meantime the boring is continued in other holes so as to reach various parts of the sands. Thus we find that at many of the wells there are a number of borings effected as at *EE*. Often a dozen or 20 holes are thus put in. A portion of these holes are pretty sure to be productive. It all depends upon the nature of the deposits. The writer found that most of the operators were making very satisfactory headway with the submarine wells. At first there were many delays, owing to lack of proper apparatus for putting in proper borings for tapping deposits under the waters, and the disappointments were frequent. Considerable capital has been invested in the submarine oil wells of California, and this fact is beginning to tell in the introduction of new machinery and improved processes for carrying on the work. At first it was difficult to tap the proper localities and many an oil well engineer went astray in his calculations. Others simply "tumbled on to" the paying deposits and reaped rich returns; but the whole business has been reduced to a scientific basis, and to-day the outlook is quite encouraging. The quality of the oil is good, and it sells freely in the markets of the West. There has been a great foreign demand for petroleum oils in recent years, and the oils from the submarine wells have found an outlet in that direction.

Mode of Erection of Derrick for Operating Sea Wells.—In Fig. 3 is shown a plan of the wharfage structure of a derrick for operating sub-

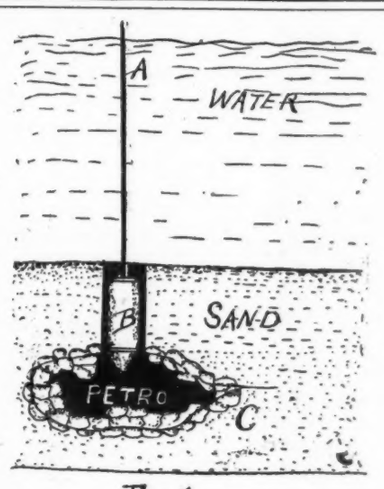


Fig 1

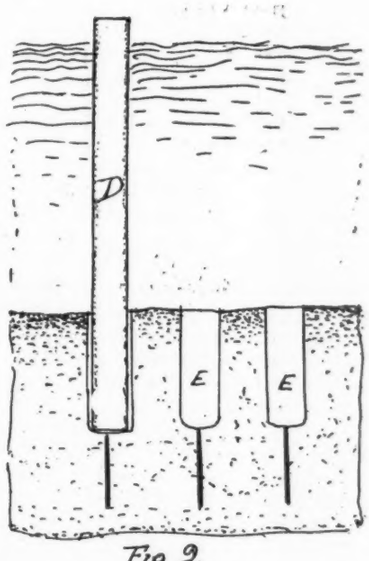


Fig 2

Operations in the Submarine Oil Wells of California.

marine wells. The process of installing one of these plants consists of first selecting the site over which the drilling is to be done, and then piles are driven. The piles are usually very long, in fact, the longest obtainable, so as to be available in deep water. Sometimes the piles are joined and double lengths used to get the proper height. The pile system is strengthened by series of cross timbers, something after the idea shown in the illustration. On top of the piles is the timber work for forming the flooring for the machinery for working the plant. This is necessarily very powerful, so as to sustain the weights of the steam boiler and engine required to run the drilling rig. Next the derrick is erected, as at *F*. This calls for proper proportioned lumber of the usual kind, and the pattern upon which the derrick is built is the same as on solid earth. The engine is stationed at *G* in nearly the same locality as when working on land. The boiler house is at *H*. Usually the house is surfaced with sheet metal and everything made fireproof. The drilling rod is represented on the drawing at *I*.

Drilling Tools.—The process of cutting the proper holes in the sands at the bottom of the waters does not vary very greatly from the process of boring ordinary wells. Some of the drilling bits, however, are specially designed for the purpose intended. Fig. 4 shows one of the special bits required for service in the petroleum sea well working. This bit is made cylindrical in shape, as marked *K*, this cylinder being steel. Into the side of it, and running parallel with the tube, are the four-side cutters, or reamers, as shown. These blades ream the sides of the boring and develop the diameter of the hole to an even and proper size. The spirally arranged disks at the point *J* do the cutting and penetrating. The tool is revolved on the rotary drilling plan, and the point with the spiral disks forced into the strata and a boring results. As fast as the strata is released the refuse is removed by the sand pump or other means. Another pattern of boring tool seen by the writer in service at these wells is presented in Fig. 5. The shaft which connects with the main revolving rod of the boring rig is indicated at *M*. The point is chisel-shaped and the tool is used chiefly with the shock system and is useful for penetrating hard and rocky bottoms. Another class of drilling tools is shown by the same in Fig. 7. The shaft for annexing to the drilling gearing is marked *N*. This tool is for general service.

Water Tight Apartments.—Sometimes when the water is shallow, and it is known that oil deposits may be tapped, the process of putting in water tight apartments for the workmen is adopted. This plan is illustrated in Fig. 8. The mode of setting up one of these affairs consists in driving the timbers into position at proper distances and depths to make the form desired. Very heavy lumber is used and the timbers are braced inside and out with cross pieces and brackets. Divers are employed to adjust and bolt these cross pieces and brackets in position. Then the interior is pumped clear of water. The water line on the outside is represented in the sketch at *RR*. The interior is now in readiness for the workmen. They proceed to first sink a surface well and then this is supported with timbers, as shown at *O*. Sometimes, however, the process of boring is undertaken at once, without the surface well. The boring rod is marked *P*. This is operated from the wharf and derrick above on the same plan as in the ordinary drilling. Evidently there is quite a field for the development of the submarine oil industry, and with improved machinery and advanced ideas the work will progress.

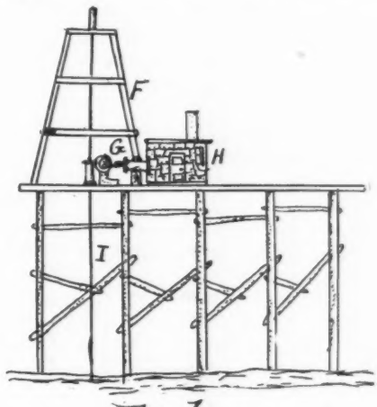


Fig 3

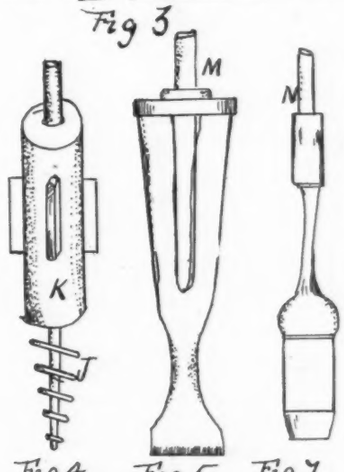


Fig 4 Fig 5 Fig 7

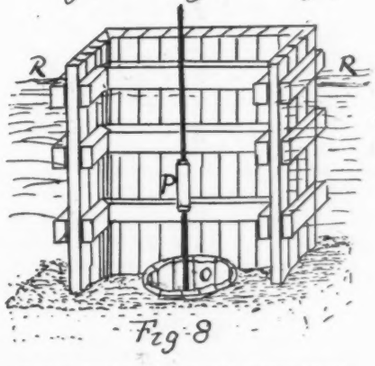


Fig 8

Devices Employed in Sea Well Drilling for Oil.

Gleanings from the 17th Annual Report of the Board of Gas and Electric Light Commissioners of Massachusetts.

By "A. B."

On looking over the last Report of the Massachusetts Gas and Electric Light Commissioners almost the first point to attract attention is the apparent gradual shaping of the course of quite a number of companies toward the purchase of their gas or electricity from some nearby concern which has a larger producing plant.

In the case of gas this becomes particularly significant, when considered in connection with the several recent successful attempts at the distance transportation of artificial gas under pressure through comparatively small trunk mains. How much this may mean to the by-product coke oven has not yet been fully demonstrated at Everett, but lines for development are expected to be soon indicated by results in New Jersey.

Two plants for the general distribution of acetylene have been installed, one each at South Hadley and Marion. While the price of acetylene gas to consumers is not stated, it probably is not far from $15 per 1,000 cubic feet, which, considering its illuminating power, would place it within range as an attainable luxury, as the special dangers of its use remain at the generating plant; but acetylene for heating and cooking still comes rather high.

It seems rather a doubtful compliment to the electric meter that the statute deems it to be correct if it does not vary more than 5 per cent. from the standards, while the gas meter is acknowledged to be the more exact instrument of the two, by the fact that more than a 2 per cent. variation in its records is declared to be excessive.

It is unfortunate that the standards for gas meter testing—*i. e.*, the meter provers—are not more portable, as, in the methods adopted by the Commissioners for the testing of electric meters, cognizance is taken of the fact that all such measuring instruments are delicate apparatus and liable to be affected by careless handling in transportation, therefore should properly be tested where and under the same conditions as they are to be used.

The Commissioners should be complimented on their stand against the communistic notions of some of the advocates of municipal ownership. In considering the Newton petition they say: "* * * The Board cannot approve a policy by which the rates for municipal use are made so low as to impose upon private consumers the entire burden of the investment charge." Why, indeed, should private users of gas or electricity be as a class assessed a special tax for the municipal lighting? This is again brought out, and even more clearly, in the discussion of the Worcester petition, on page 25 of the Report.

The Quincy petition certainly developed a condition of affairs not easily disposed of. Bankers swindled by poor securities and false representations found themselves in possession of a plant, wholly inadequate to meet the least increase of business, and in a territory with such conditions as to appear very discouraging as a gas proposition. They were obliged to hold on, barely getting their interest while looking for some enterprising fellow to come and relieve them of their load.

Meanwhile the citizens called for extensions which the Company declined to make in fear of sinking still more capital into the wreck irretrievably. Could a case be devised to more positively emphasize the fact that success in the gas business is not assured by the oversight of excellent bankers acting as managing directors, even in the slightest degree as compared with the results to be attained by a level headed, *trained* gas manager backed by directors who can look ahead through the swath he cuts for them. For instance, compare with Newton, making all due allowance for difference in population and territory.

It is significant that of the deaths recorded as by gas, just 50 per cent. were deliberate suicides, about 14 per cent. were "drunks," and over 8 per cent. were doubtful, as to whether suicides or accidents. The accidental and doubtful together averaged roughly 1 in 86,000 population. The usual crop of suicides has been quite favored by the energetic efforts of the promoters of a water gas crusade in Massachusetts, who made liberal use of the press in showing how quickly, certainly and painlessly death could be produced by that which they very shortly afterwards began to manufacture at one of their own plants.

Among 67 gas companies there are no less than 37 water gas plants representing quite an aggregate of investment, but as a result of that silly crusade it apparently is the hope of some of the Boston fire eaters to have this all wiped out, and they were very much disappointed that the Commissioners' Report did not take official cognizance of their efforts. The Board could hardly have done so as the matter was not formally and properly brought before them, although if it had been, their well known common sense, impartiality and justice would soon have shorn the whole matter of its bombastic, spectacular and sensational red headlines, and the remaining kernel of the nut would have appeared in its true light, a matter of intelligent use rather than ignorant abuse of a good servant.

The accidents almost all demonstrate the necessity of there being some form of inspection, either by the gas companies or by competent officers of the city or town, of not only the tightness of the piping but also of all fixtures and connections for gas. It is too often the case that when the piping in a building is inspected the gas brackets and other fixtures are represented only by caps or plugs, and the fixtures—the very part of the outfit that is almost invariably found to be at fault—are required to pass no other examination than as to their gilt, artistic design, or simply cheapness. Ten times more lives are sacrificed for cheap gas fixtures with bad stopcocks than can possibly be charged to the difference in composition of coal gas and carburetted water gas.

As to the stocks of some of the companies, it is not necessary to comment on the facts shown by the following table:

Name of Company.	Capital Stock.	Amount Held in Mass.	No. of Stockholders Outside of Mass.	Dividend Rate Declared.
Bay State Gas Co.....	$2,000,000	.....	5	10½ per cent.
Boston Gas Light Co.....	2,500,000	$500	5	12 "
Brookline Gas Light Co...	2,000,000	2,000	3	11⅔ "
Dorchester Gas Light Co..	519,600	1,400	5	11 "
Roxbury Gas Light Co....	600,000	.....	4	7 "
South Boston Gas Light Co.	440,000	1,000	6	5½ "
Mass. Pipe Line Gas Co...	1,000,000	999,900	1	.. "

Chicopee, Dedham and Fall River are the only other Companies controlled from outside of the State.

The gas stove output shows in general a healthy growth, though most noticeable in the case of Haverhill, where the number of stoves in use the previous year must be multiplied by almost 6 to reach the number given in the last Report. Thus it appears that the decision of the Board in February, 1900, requiring the price of gas in Haverhill to be reduced to 80 cents, certainly did awaken a lot of latent energy, even though that decision may not yet have become of effect as to the price of gas. As to stoves out per 1,000 population, omitting Cottage City because of the great variation of population during the seasons, Haverhill leads easily with nearly 113, Dorchester following with 89, Lawrence with 78 and Framingham with 74.

It is rather noticeable that, while the increase in profits in the electric lighting business during the year covered by the last Report amounted to about $162,522, over 45 per cent. of this was in the electrical departments of gas companies, showing a gain of over 27 per cent. for them as against less than 5 per cent. gain for the electric companies. Out of 67 gas companies, 19, and out of 62 electric companies, 26 failed to declare dividends.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

CONSTRUCTION work on the gas plant for Charleston, Ills., is underway.

AT the annual meeting of the Bordentown (N. J.) Gas Light Company the following officers were elected: Directors, John P. Hutchinson, J. H. Longstreet, Jno. L. Kuser, R. H. Aaronson and Jno. H. Hutchinson; President, J. P. Hutchinson; Vice-President, J. H. Longstreet; Secretary and Treasurer, R. H. Aaronson.

DISPATCHES to the newspapers, dated Boston, 7th inst., are to this effect: "Judge Colt, of the United States Circuit Court, to-day appointed Mr. Robt. M. Burnett Receiver for the New England Gas and Coke Company, on the application of the United Coke and Gas Company of West Virginia, which brought a bill in equity against Henry M. Whitney and others, Trustees. The basis of the proceeding is that the New England Company is in an insolvent condition, and is unable to meet its obligations, including an indebtedness of $360,000 to the complainant. It was alleged that unless the Court interposed with the appointment of a receiver the property of the Company might be sold for taxes long overdue, with the result that the works would be shut down. The Company is at present engaged in the manufacture and sale of gas to the Brookline Gas Company, the Jamaica Plain Gas Light Company, the Dorchester Gas Light Company, the Charlestown Gas and Electric Company, the Chelsea Gas Light Company and the Dedham and Hyde Park Gas and Electric Company, and if the works of the Company be shut down there will be a great inconvenience to the public. Kidder, Peabody & Co. and J. & W. Seligman & Co., of New York, at the re-

quest of many of the holders of the Company's securities, are preparing a reorganization plan.

THE municipal election held some days ago in Webster City, Ia , to determine whether or not the city should construct and operate a gas works on public account, resulted in a decided indorsement of the proposition.

THE proprietors of the Pontiac (Mich.) Light Company have announced a new sales' schedule, which took effect the 1st inst. Under it the gross rate for all uses is put at $1.50 per 1,000 cubic feet, prompt payment (within 10 days) to entitle the consumer to a discount of 25 cents per 1,000. Heretofore the rates at Pontiac were: For lighting use, gross, $1.75; net, $1.50; for heating and power use, gross, $1.50; net, $1.25.

WE understand that a controlling interest in the Pottsville (Pa.) Gas Company has been sold to Mr. V. W. Dukes, of Philadelphia. The names of the real parties to the transaction have not been disclosed.

THE proprietors of the Essex and Hudson (N. J.) Gas Company are considering the advisability of extending the main system to Verona and Caldwell, which towns are on the extreme western boundary of its territory.

TREASURER HAYWARD and General Manager Ramsdell, of the Connelly Iron Sponge and Governor Company, of this city, are quite satisfied over the manner in which business on the Company's account was started in this season. That they and their associates have good reason for satisfaction is shown by the following list of governor sales recently made; Consolidated Gas Company, N. Y. City, two 36-inch; New Orleans, La., one 30-inch; Newark, N. J., one 30-inch; Paterson, N. J., one 24-inch; Waterbury, Conn., one 24-inch; Oshkosh, Wis., one 16-inch; Allentown, Pa., one 24-inch; Reading, Pa., two 16-inch; Auburn, N. Y., one 10-inch; Boonton, N. J., one 8-inch; Suffern, N. Y., one 8-inch; Durham, N. C., one 8-inch; Berkley, Va., one 6-inch; Kingston, N.Y., two 6-inch. The Company also reports recent sales of exhausters, as follows: Two 36-inch to the Consolidated Gas Company, of New York; three 24-inch to the Essex and Hudson Company, of Newark, N. J., and one 8-inch to the Boonton (N. J.) Company. The Company further reports that inquiries of the business-meaning sort are many.

MANAGER E. H. YORKE and Head Salesman E. A. Willard, of the Portland (Me.) Gas Light Company, are likely responsible for the putting together of a very well arranged "Catalogue and Reference Book of Gas Appliances" that are carried in stock in the Portland Company's gas appliance store. In any event, the compilers, whether Yorke and Willard or not, are to be congratulated on the result of their labors, for the catalogue is a most attractive one, and its distribution in the residence districts of Portland will undoubtedly cause many a householder to visit the Company's handsome gas appliance store, 11 Temple street, with a view to making a purchase of one sort or another.

A CORRESPONDENT in Burlington, Vt., forwards the following under date of the 5th inst.: "As had been previously announced a controlling interest in the Burlington Gas Light Company and in the Consolidated Electric Company, of Burlington, has been acquired by the American Gas Company, of Philadelphia; but there will be no change in the local management. Mr. F. H. Parker will continue as Manager and Superintendent, much to the satisfaction of the residents of Burlington, with whom the genial Parker has always been a pronounced favorite. At a meeting held here the 2d inst. the following officers were chosen to direct the affairs of the Companies: Burlington Gas Light Company, Directors, Messrs. W. Stroud, S. P. Curtis and R. L. Babcock, of Philadelphia; and F. H. Parker and J. J. Flynn, of Burlington; President, S. P. Curtis; Treasurer, M. W. Stroud; Superintendent and Clerk, F. H. Parker. The Consolidated Electric Company, Directors, S. P. Curtis, R. L. Babcock, F. H. Parker, J. J. Flynn, M. W. Stroud, M. Riley and W. L. Fox; President and Treasurer, M. W. Stroud; Clerk, F. H. Parker. The plants will be improved.

MESSRS. WM. AND SINCLAIR MAINLAND, of Green Bay, Wis., have secured control of the gas and electric light plants at Fargo, N. D.

MR. C. F. MCCARTHY, President of the Pacific Construction Company, of San Francisco, announces the purchase of the plant and franchises of the Modesto (Cal.) Gas Light and Coke Company. The plant will be rebuilt.

"M. S." writes us that control in the Gilroy (Cal.) Gas Light Company is likely to be obtained by those interested in the project to establish there an electric lighting plant.

AT a meeting of the Directors of the Charleston (S. C.) Consolidated Railway, Gas and Electric Company, Mr. P. Balaguer was elected Secretary, and Mr. Montague Triest, formerly Cashier of the Company, was chosen Treasurer. These elections were to fill vacancies occasioned by the death of Mr. J. Bannister Hall.

AT the annual meeting of the shareholders in the Peoples Light, Heat and Power Company, of Phillipsburg, N. J., the following officers were elected: Directors, Liddon Flick, Clarence Walters, Thomas Newman, John A. Bachman, David Mixsell, W. H. Walters and E. C. Jones; President, Liddon Flick; Vice-President, E. C. Jones; Secretary and Treasurer, David Mixsell.

WE have received a copy of the following self-explanatory notice, which was issued prior to the 1st inst., by the proprietors of the Gas Company, of Montgomery County, Pa., the headquarters of which are in Norristown, Pa.: "In furtherance of the policy of the Company to gradually reduce the price of gas, the Gas Company of Montgomery County announces a reduction to take effect on gas consumed after April 1st, 1902. A discount of 10 cents per 1,000 will be allowed, instead of 5 cents as heretofore, for payment of the bills by the 10th of the month after consumption. The net price will therefore be $1.20 per 1,000 on bills rendered May 1st. This is the second reduction in less than 3 years, and is made notwithstanding the greatly increased cost of coal, cast and wrought iron pipe, fittings and other materials entering into the manufacture and distribution of gas. This price is also lower than in neighboring towns except Philadelphia. The Company desires to conduct its business in a modern, progressive manner, and will at all times be glad to be informed of complaints of supply, service or other causes. Burners and tips are supplied free, for the asking. Gas at the price at which it is sold in Norristown is within the reach of all, and its convenience and usefulness may be availed of with economy, safety and comfort."

THE Philadelphia Suburban Gas Company has purchased a valuable plot on the river front, between Tilghman and Morris streets, which adjoins its present works' site at Chester, Pa. The Company proposes to make the Chester site eventually its central manufacturing station.

AT the annual meeting of the Knoxville (Tenn.) Gas Company the following officers were chosen: Directors, J. Y. Johnston (who succeeds the late Col. R. R. Swepson, who was also President of the Company), W. P. Washburn (who succeeds Mr. L. H. Spilman), F. L. Fisher and John E. Hood; President, J. Y. Johnston; Vice-President, W. P. Washburn; Secretary and Treasurer, John E. Hood. The latter is also to act as General Manager.

"AT a special meeting of the shareholders in the Rochester (N. Y.) Gas and Electric Company, held April 2d, the affairs of the session were directed by the President, the Hon. Frederick Cook. In accordance with the call for the meeting, the regular semi-annual dividend of 3 per cent. on the common stock of the Company was declared, payable April 15th, until which date the common stock books will be closed. There was more than the usual interest in the meeting of the Directors of the Company, owing to various rumors which have been in circulation regarding an alleged consolidation of the Company with other electricity interests in this city. It was stated, however, that the subject of consolidation did not come up at the meeting. After the meeting it was stated that there has been no consolidation, sale or purchase. It was also stated that the question of withdrawing the offer to furnish gas to consumers for $1 per 1,000 feet, after April 1, 1903, was not even broached at the meeting. The Company took formal possession of the cotton mill property at the Upper Falls, with its 10 water rights, yesterday, the purchase for $105,000, announced some time ago, having been consummated. The machinery of the cotton mill has been removed and shipped to Cohoes, and it is understood that different parties are negotiating to rent the building for manufacturing purposes. In addition to the 10 additional water rights acquired by the Gas and Electric Company in the cotton mill purchase, it is understood that it gave the Company a desired advantage in the way of access to its station on the west side of the river at the Upper Falls, which is to be greatly enlarged.—F. T. V."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
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PACIFIC COAST GAS ASSOCIATION.

Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, APRIL 14, 1902.

The Market for Gas Securities.

The vagaries shown in the general share market last week, aided by certain well-pronounced eccentricities in the ranks of the money lenders, as to quick changes in the rates for call loans, had the effect of putting quotations on decidedly lower levels than those recently recorded. There was quite a bit of trading in Consolidated, most of which was done at gradually receding prices, the closing to-day (Friday) being 224¾ to 225¼. The affairs of the Company are in satisfactory shape, and some progress has been made towards the settlement of the "solidification" of the Company's real estate platting at Astoria, which remark, of course, applies to the argument between the authorities and the Company as to the closing of certain streets, which had never been more than "theoretically" opened.

Brooklyn Union, in sympathy with Consolidated, is much lower as to the bid price, but holders show no disposition to part with it, for there is a difference of 5 points between the valuation put upon it by bidders and owners—222 to 227. Baltimore Consolidated is a trifle weaker, as is Peoples, of Chicago. Indianapolis securities show decided strength, the bonds of the Company being in strong demand. Washington gas keeps on advancing. It is about settled that Congress, which body has charge of the legal fortunes of the Washington Company, will grant it the right to absorb the Georgetown Company and the further right to largely increase its capital stock. The market for gas bonds continues strong.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.
16 WALL STREET, NEW YORK CITY.
APRIL 14.

☞ All communications will receive particular attention. ☜ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	224¾	225¼
Central Union, Bonds, 5's	3,000,000	1,000	110	111½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	315	325
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	111½	..
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	109	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	..
Standard	5,000,000	100	130	140
Preferred	5,000,000	100	150	160
Bonds, 1st Mortgage, 5's	1,500,000	1,000	118	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	222	227
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	1	1¼
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works...	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust....	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	10	10⅛
" " Bonds, 5's	5,250,000	1,000	84	84½
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	102⅛	102¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	108	109
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	68½	69
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	13	14
" Con. Mtg. 5's	380,000	1,000	80	81
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	382,000	1,000	70	73
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	.	.
" Bonds	2,000,000	..	53	55
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	102	104
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	78	..
" Bonds, 6's	2 650,000	..	105	108
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100		89
Preferred	2,500,000	100	..	110
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	57	62
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	25	87
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	102	102⅛
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	48	48½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's.	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's..	2,465,000	1,000	90	92
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	95	96½
Syracuse, N. Y.	1,750,000	100	15	17
Bonds	1,612,000	1,000	95½	97½
Washington, D. C	2,600,000	20	428¾	431¾
First mortgage 6's	600,000	..	..	..
Western, Milwaukee.				
Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del	600,000	50	232	..

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, PA., March 12, 1902.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable April 15th, 1902, to stockholders of record at the close of business, March 31, 1902. Checks will be mailed.

1397-5 LEWIS LILLIE, Treasurer.

Position Wanted.

A YOUNG MAN, age 30, at present employed as superintendent of a gas company, 10 years' practical experience in all branches pertaining to coal or water gas, desires similar position. Locality no object.

Address, "B. W.,"
1399-3 Care this Journal.

WANTED,

Position as Superintendent of Gas Plant,

By a man with several years' experience, both coal and water gas. Familiar with details connected with manufacturing, distribution and office work. Best of references. Town in the West preferred.

1400-2 Address, "H.," care this Journal.

WANTED,

Situation as Superintendent of Gas Works,

By a man of 35. Thoroughly familiar with coal and water gas. Twelve years' experience. Has had good success in increasing output and getting business. Can furnish good references. Thoroughly practical and familiar with all branches of the business. Address, "N. V. B.,"

1399-tf Care this Journal

Position Desired

By a Practical Gas and Electric Engineer.

In present position for the past 10 years. Good reasons for making change. Fourteen years in the business. Has reconstructed several plants. A practical office man, as well as being competent to lay out extensions and new work that owners of plants may contemplate. References exchanged.

1398-4 Address, "PROGRESSIVE," care this Journal.

WANTED,

Position as Manager or Superintendent,

By an energetic man, having had a large experience in the manufacture and distribution of both coal and water gas. Fully competent to supervise all improvements and extensions. A1 references. Address, "W. J. V.,"

1401-3 Care this Journal.

WANTED,

A CANVASSER,

Acquainted with canvassing for gas ranges and house piping in a suburban territory. Small salary and commission to right man. Address,

NEWTOWN AND FLUSHING GAS CO.,
1401-1 FLUSHING, N. Y.

WANTED,

Street Foremen and Caulkers.

A gas company in the vicinity of New York city would like to employ a few main and service foremen and caulkers. Would prefer men familiar with gasfitting and meter work. Can furnish steady work the year around, at good wages, to the right kind of men.

1399-4 Address, "E. H. O.," care this Journal.

WANTED,

Foreman for Gasfitting Department and Shop.

Address, "GAS COMPANY,"
1399-tf Care this Journal.

INVENTIONS FOR EUROPE.

Engineers of standing and acquaintance in Europe are desirous of securing the handling of some good inventions abroad. We want such as will justify the organization of companies. Liberal propositions for the right articles.

ZERBE & ZERBE, Engineers,
1345-tf 11 Broadway, New York.

GAS MAKER

WANTED,

To operate a standard Lowe gas plant in a growing town, 60 miles from New York. Must be steady, and thoroughly understand the Lowe system. A permanent place for the right man. Address, "J. C.,"

1401-tf Care this Journal.

WANTED,

A WET METER,

In first-class operative condition, capable of passing 35,000 to 40,000 cubic feet in 12 hours. Address at once, giving make, age and full description of machine,

NORTH ADAMS GAS LIGHT CO.,
1400-2 NORTH ADAMS, MASS.

WANTED,

Second-Hand Apparatus, as follows:

4 Purifier Boxes, about 8 feet by 8 feet by 2½ feet.
1 Five-foot Station Meter.
1 Set Water Gas Apparatus, 4 feet or 4½ feet.

Send full specifications, plans and price, with date of delivery. Address,

"STANDARD,"
1378-tf Care this Journal.

BONDS WANTED.

We Purchase Entire Issues of Bonds on Gas, Water Works and Electric Light Properties

In progressive cities; or we will buy such properties outright. Write us if you contemplate issuing bonds, or desire to sell.

McDONALD, McCOY & CO.,
1401-tf 171 La Salle Street, Chicago, Ills.

FOR SALE.

FOUR PURIFIERS, 10 feet by 10 feet, by 6 feet deep, with 24-inch seal. Oxide chutes, with self-sealing covers, dry center seal, 10-inch connections, supporting columns and I-beams, hydraulic lifts, track and transferring tackle. Ready to ship about May 21st.

SOUTH BEND GAS AND FUEL COMPANY,
1401-2eot South Bend, Ind.

FOR SALE.

One 4-foot Lowe Water Gas Set,

With scrubber, condenser, engine, blower, boiler and pump; all in first-class condition.

Address,
CHARLES THOMAS,
No. 97 Main Street,
1401-tf FLUSHING, N. Y.

IN THE MARKET.

WE PURCHASE:

Gas properties,
Electric light properties.
Street railway properties.
Also desirable franchises.

W. R. FABEN CONSTRUCTION CO.,
1383-tf 317 St. Claire Street, Toledo, O.

GAS BURNERS,

To burn a given amount at a stated pressure, made to order. Samples furnished. Also, small oil and air valves, slow-feed valves for high pressure, and small brasswork in general.

Drip Pumps, Service Cleaners, Gasfitters' Proving Pumps and Mercury Gauges.

C. GEFRORER & SON,
248 North 8th Street, Philadelphia, Pa.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
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AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.

Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, APRIL 14, 1902.

The Market for Gas Securities.

The vagaries shown in the general share market last week, aided by certain well-pronounced eccentricities in the ranks of the money lenders, as to quick changes in the rates for call loans, had the effect of putting quotations on decidedly lower levels than those recently recorded. There was quite a bit of trading in Consolidated, most of which was done at gradually receding prices, the closing to-day (Friday) being 224¾ to 225¼. The affairs of the Company are in satisfactory shape, and some progress has been made towards the settlement of the "solidification" of the Company's real estate platting at Astoria, which remark, of course, applies to the argument between the authorities and the Company as to the closing of certain streets, which had never been more than "theoretically" opened.

Brooklyn Union, in sympathy with Consolidated, is much lower as to the bid price, but holders show no disposition to part with it, for there is a difference of 5 points between the valuation put upon it by bidders and owners—222 to 227. Baltimore Consolidated is a trifle weaker, as is Peoples, of Chicago. Indianapolis securities show decided strength, the bonds of the Company being in strong demand. Washington gas keeps on advancing. It is about settled that Congress, which body has charge of the legal fortunes of the Washington Company, will grant it the right to absorb the Georgetown Company and the further right to largely increase its capital stock. The market for gas bonds continues strong.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.
16 WALL STREET, NEW YORK CITY.
APRIL 14.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	224¾	225¼
Central Union, Bonds, 5's	3,000,000	1,000	110	111½
Equitable Bonds, 6's	1,000,000	1,000	105	
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	315	325
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	111½	..
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River.. Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	109	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	..
Standard	5,000,000	100	130	140
Preferred	5,000,000	100	150	160
Bonds, 1st Mortgage, 5's	1,500,000	1,000	118	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	222	227
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	1	1¼
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works...	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	10	10⅜
" " Bonds, 5's	5,250,000	1,000	84	84½
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	102⅛	102¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	108	109
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
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Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	68¼	69
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	13	14
" Con. Mtg. 5's	880,000	1,000	80	81
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	332,000	1,000	70	73
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	.	.
" Bonds	2,000,000	..	53	55
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	102	104
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	78	..
" Bonds, 6's	2 650,000	..	105	108
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100		89
Preferred	2,500,000	100	..	110
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	57	62
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	110½
" 6 per cent. scrip, due 1910	100,000	25	25	87
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	102	102⅛
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	48	48½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	90	92
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	95	96½
Syracuse, N. Y.	1,750,000	100	15	17
Bonds	1,612,000	1,000	95½	97½
Washington, D. C	2,600,000	20	428¾	431¾
First mortgage 6's	600,000	..	..	..
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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., March 12, 1902.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable April 15th, 1902, to stockholders of record at the close of business, March 31, 1902. Checks will be mailed.

1397-5 LEWIS LILLIE, Treasurer.

Position Wanted.

A YOUNG MAN, age 30, at present employed as superintendent of a gas company, 10 years' practical experience in all branches pertaining to coal or water gas, desires similar position. Locality no object.

Address, "B. W.,"
1399-3 Care this Journal.

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By a man with several years' experience, both coal and water gas. Familiar with details connected with manufacturing, distribution and office work. Best of references. Town in the West preferred.

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In present position for the past 10 years. Good reasons for making change. Fourteen years in the business. Has reconstructed several plants. A practical office man, as well as being competent to lay out extensions and new work that owners of plants may contemplate. References exchanged.

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Acquainted with canvassing for gas ranges and house piping in a suburban territory. Small salary and commission to right man. Address,

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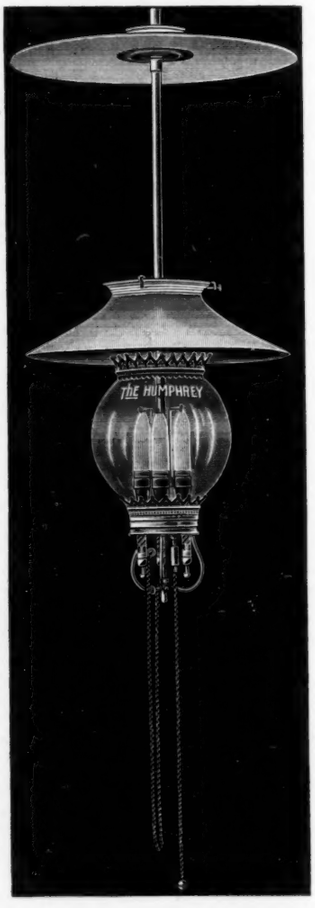

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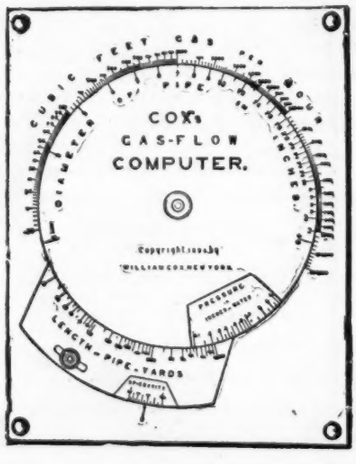

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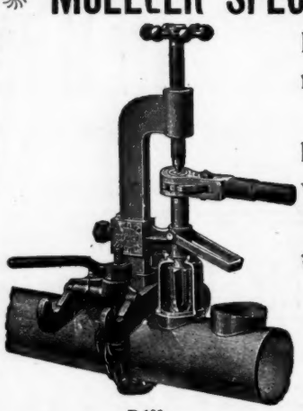

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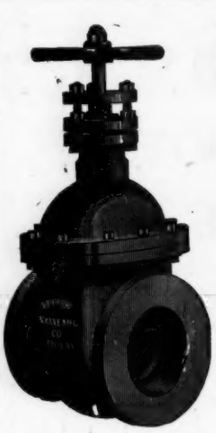

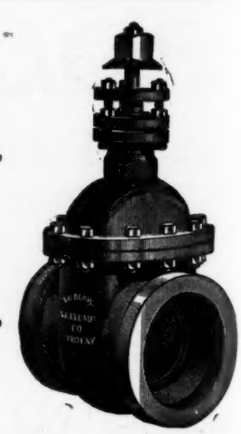

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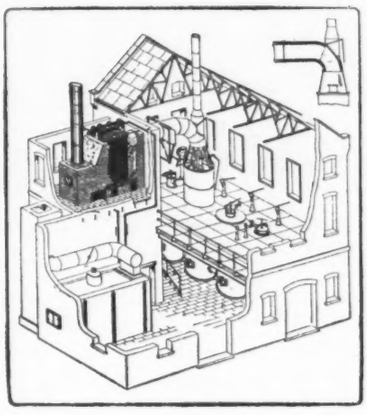

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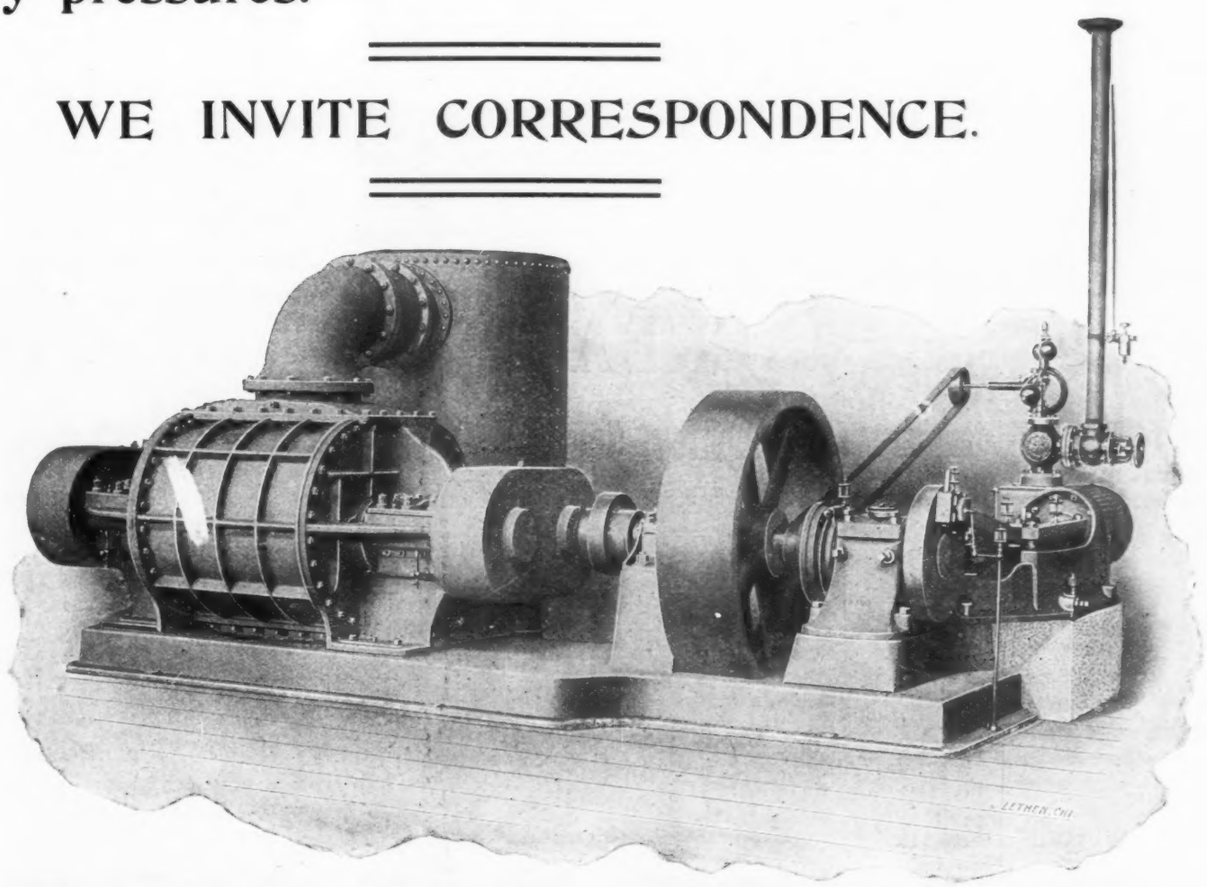

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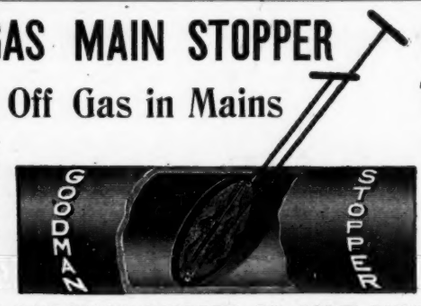

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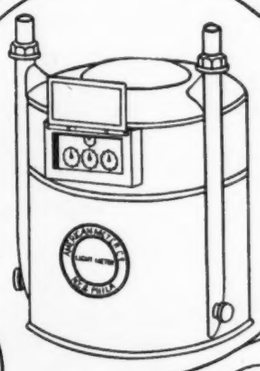

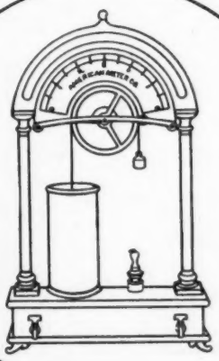

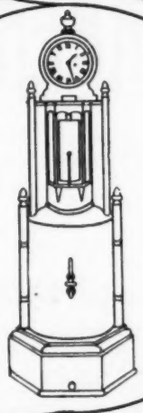

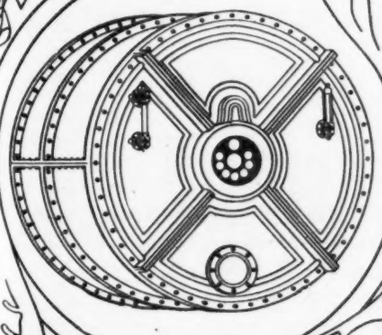

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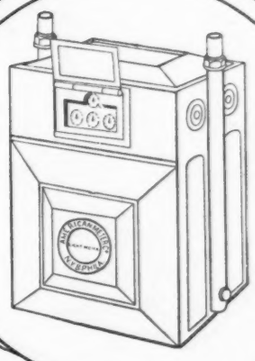

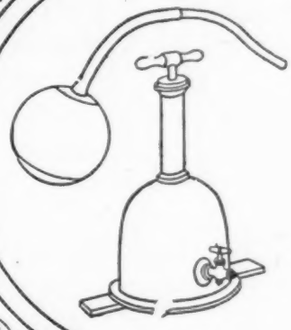

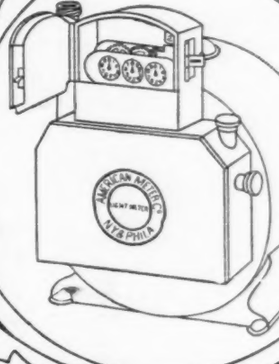

PUBLIC LIGHTING TABLE.

MAY, 1902.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	7.20 PM	2.40 AM	6.45	4.00
Fri.	2	7.20	3.10	6.45	4.00
Sat.	3	7.20	3.40	6.45	4.00
Sun.	4	7.30	3.50	6.45	4.00
Mon.	5	7.30	3.50	6.45	4.00
Tue.	6	7.30	3.50	6.45	4.00
Wed.	7	7.30 NM	3.50	6.55	3.40
Thu.	8	7.30	3.50	6.55	3.40
Fri.	9	7 30	3.50	6.55	3.40
Sat.	10	7.30	3.50	6.55	3.40
Sun.	11	7.30	3.50	6.55	3.40
Mon.	12	10.50	3.50	6.55	3.40
Tue.	13	11.30	3.50	6.55	3.40
Wed.	14	12.00 FQ	3.50	7.00	3.30
Thu.	15	12.30 AM	3.50	7.00	3.30
Fri.	16	1.00	3.50	7.00	3.30
Sat.	17	1.30	3.50	7.00	3.30
Sun.	18	2.10	3.40	7.00	3 30
Mon.	19	2.40	3.40	7.00	3.30
Tue.	20	No L.	No L.	7.00	3.30
Wed.	21	No L. FM	No L.	7.10	3.15
Thu.	22	No L.	No L.	7.10	3.15
Fri.	23	7.40 PM	9.20 PM	7.10	3.15
Sat.	24	7.40	10.10	7.10	3.15
Sun.	25	7.50	10.50	7.10	3.15
Mon.	26	7.50	11.30	7.10	3.15
Tue.	27	7.50	12.00	7.10	3.15
Wed.	28	7.50	12.40 AM	7.15	3.15
Thu.	29	7.50	1.10	7.15	3.15
Fri.	30	7.50 LQ	1.40	7.15	3.15
Sat.	31	7.50	2.10	7.15	3.15

TOTAL HOURS LIGHTING DURING 1902.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	238.30	January	423.20
February	196.20	February	355.25
March	196.20	March	355.35
April	166.40	April	298.50
May	151.40	May	264.50
June	131.10	June	234.25
July	142.40	July	243.45
August	162.00	August	280.25
September	179.00	September	321.15
October	216.30	October	374.30
November	224.10	November	401.40
December	250.00	December	433.45
Total, yr.	2255.00	Total, yr.	3987.45

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
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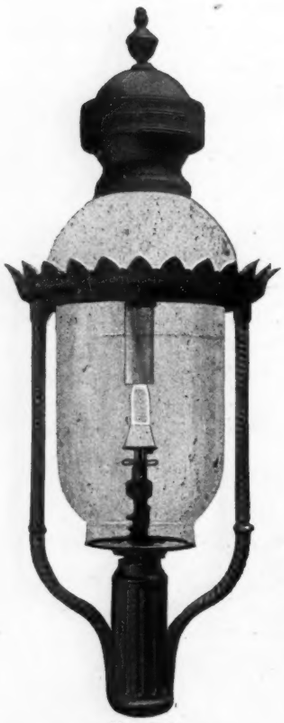

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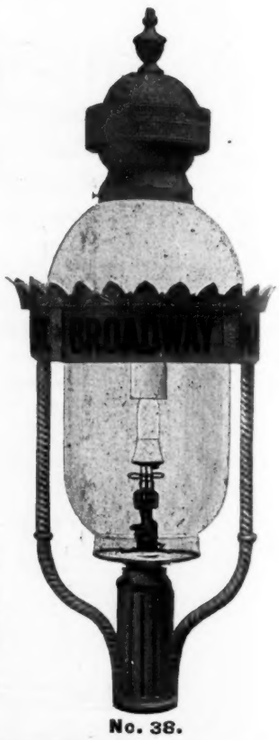

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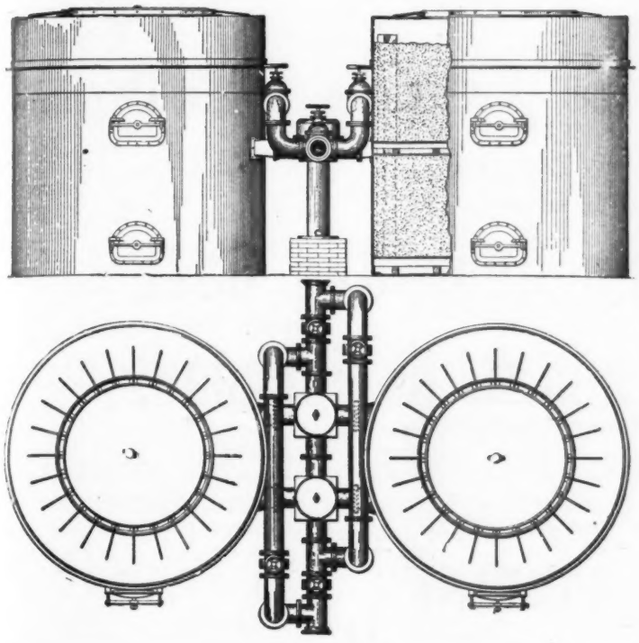

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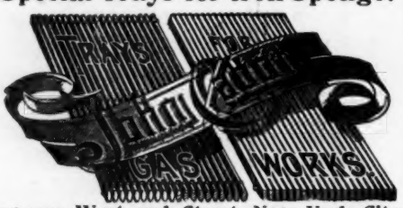

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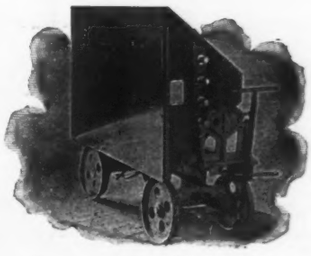

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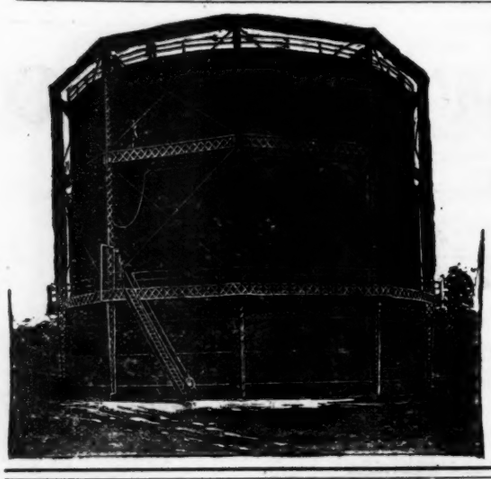

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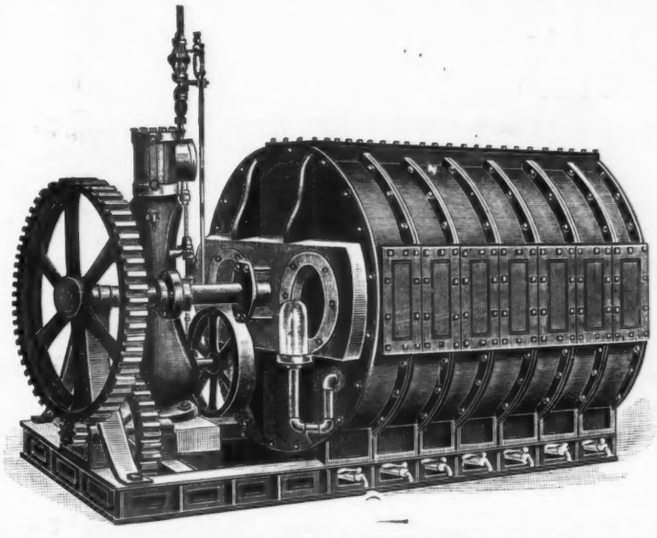

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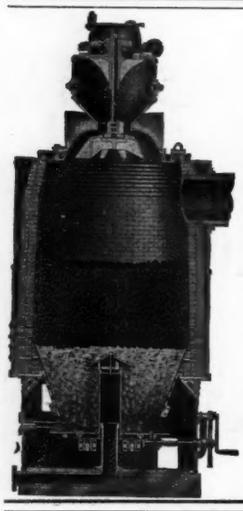

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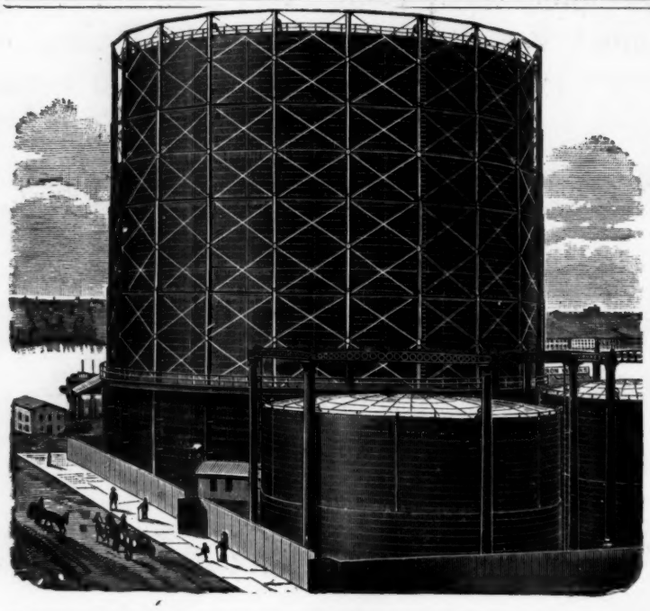

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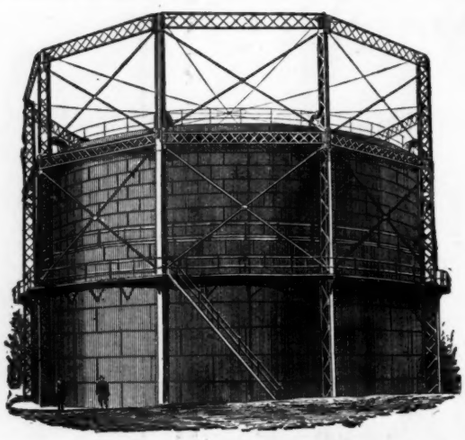

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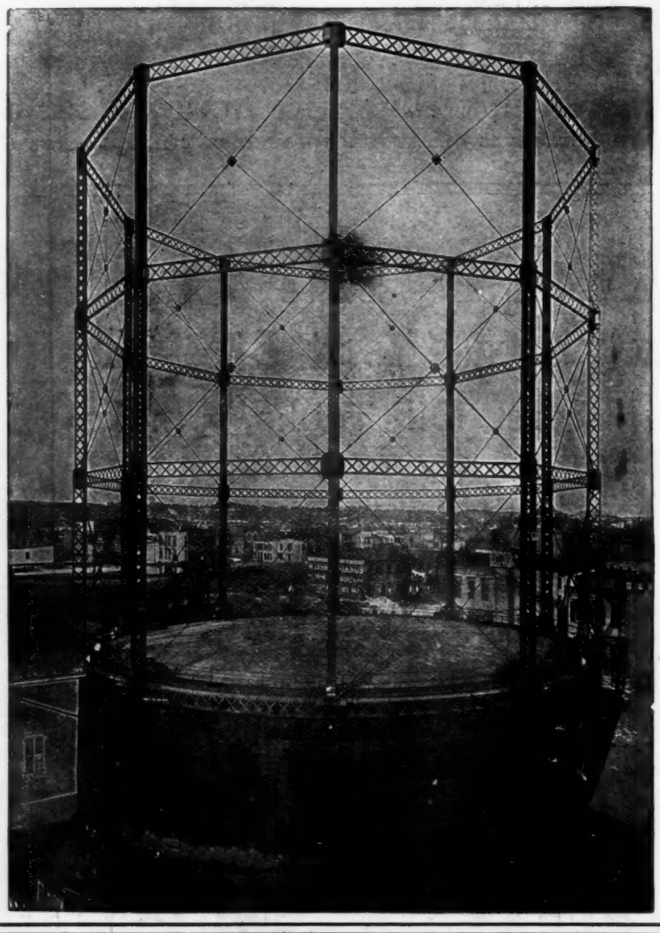

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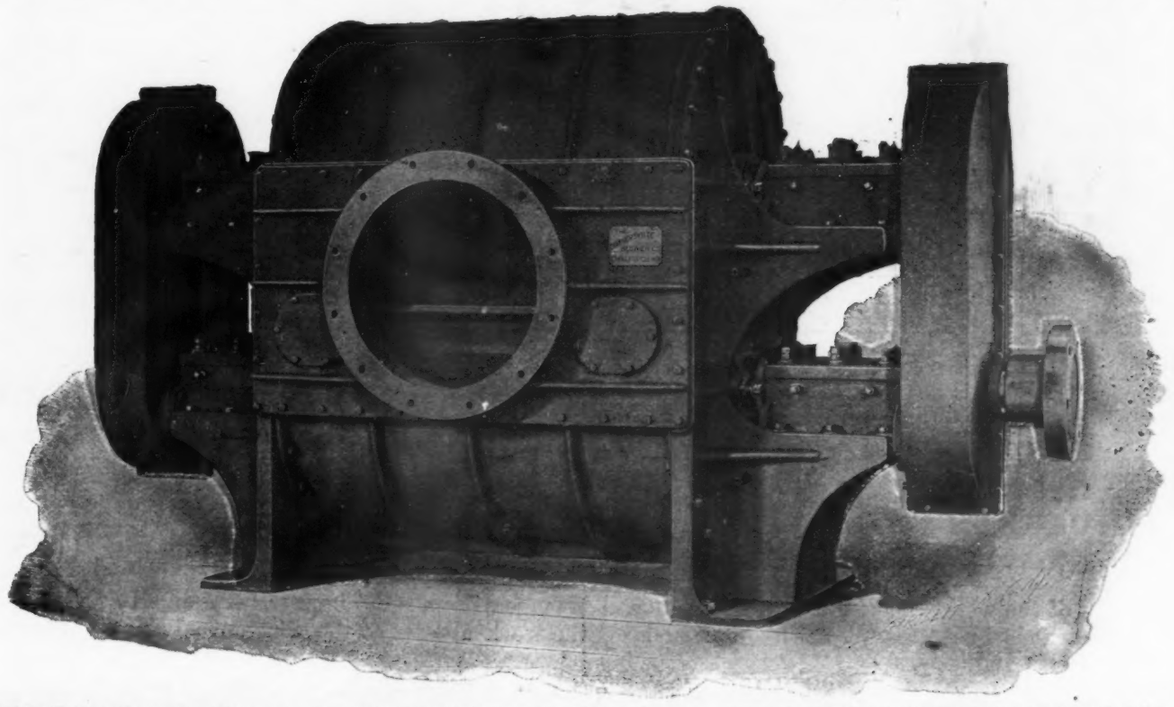

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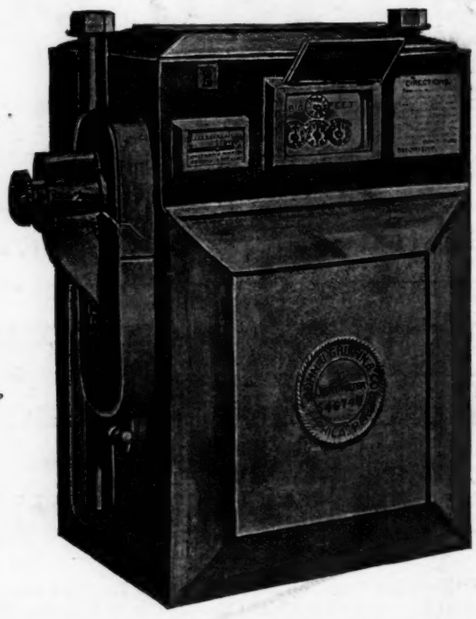

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